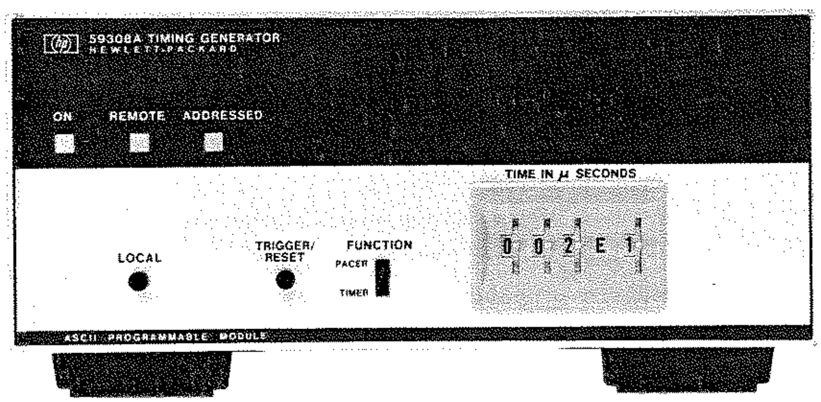
OPERATING AND SERVICE MANUAL

TIMING GENERATOR
59308A



HEWLETT hp PACKARD

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facilities, or to the calibration facilities of other International Standards Organization members.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery. Hewlett-Packard will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

OPERATING AND SERVICE MANUAL

59308A

TIMING GENERATOR

SERIAL PREFIX 1508A

This manual applies directly to the Hewlett-Packard Model 59308A with serial prefix 1508A. For instruments with serial prefixes above 1508A a manual change sheet is supplied. For instruments with serial prefixes below 1508A, refer to Section VII.

5301 STEVENS CREEK BLVD., SANTA CLARA, CALIF. 95050

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HEWLETT hp PACKARD

CONTENTS

TABLES

FIGURES

SAFETY CONSIDERATIONS

GENERAL

This is a Safety Class I instrument. This instrument has been designed and tested according to IEC Publication 348, "Safety Requirements for Electronic Measuring Apparatus", and has been supplied in safe condition.

OPERATION

BEFORE APPLYING POWER verify that the power transformer primary is matched to the available line voltage and the correct fuse is installed (see Section II, Paragraph 2-9). Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

SERVICE

Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition. Service and adjustments should be performed only by qualified service personnel.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

WARNING

IF THIS INSTRUMENT IS TO BE ENERGIZED VIA AN AUTO-TRANSFORMER (FOR VOLTAGE REDUCTION) MAKE SURE THE COMMON TERMINAL IS CONNECTED TO THE EARTHED POLE OF THE POWER SOURCE.

WARNING

BEFORE SWITCHING ON THE INSTRUMENT, THE PROTECTIVE EARTH TERMINALS OF THE INSTRUMENT MUST BE CONNECTED TO THE PROTECTIVE CONDUCTOR OF THE (MAINS) POWER CORD. THE MAINS PLUG SHALL ONLY BE INSERTED IN A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).

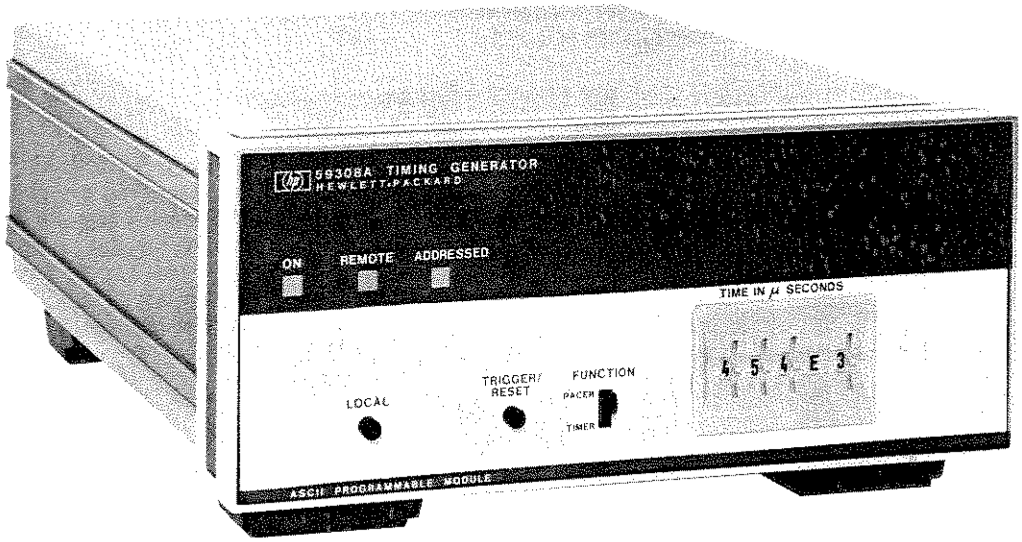
WARNING

THE SERVICE INFORMATION FOUND IN THIS MANUAL IS OFTEN USED WITH POWER SUPPLIED AND PROTECTIVE COVERS REMOVED FROM THE INSTRUMENT. ENERGY AVAILABLE AT MANY POINTS MAY, IF CONTACTED, RESULT IN PERSONAL INJURY.

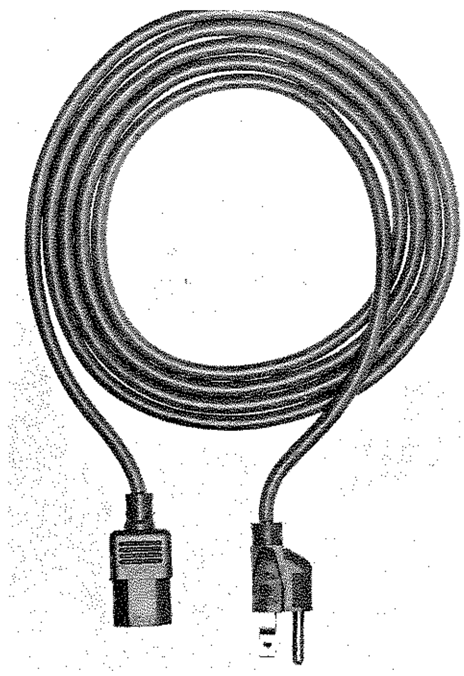
CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT:

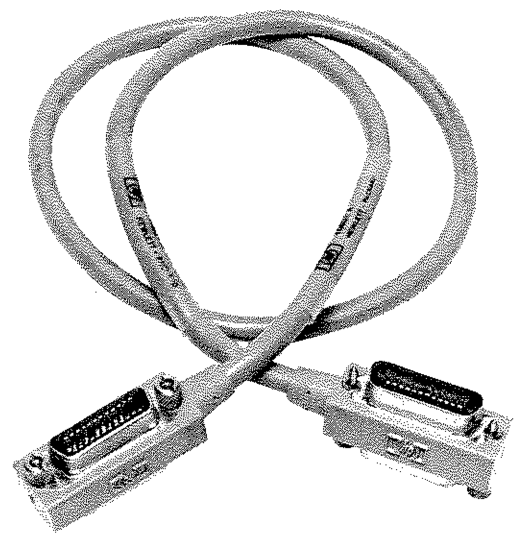
1. MAKE SURE THE INSTRUMENT IS SET TO THE VOLTAGE OF THE POWER SOURCE.
2. ENSURE THAT ALL DEVICES CONNECTED TO THIS INSTRUMENT ARE CONNECTED TO THE PROTECTIVE (EARTH) GROUND.
3. ENSURE THAT THE LINE POWER (MAINS) PLUG IS CONNECTED TO A THREE-CONDUCTOR LINE POWER OUTLET THAT HAS A PROTECTIVE (EARTH) GROUND. (GROUNDING ONE CONDUCTOR OF A TWO-CONDUCTOR OUTLET IS NOT SUFFICIENT.
4. MAKE SURE THAT ONLY FUSES WITH THE REQUIRED RATED CURRENT AND OF THE SPECIFIED TYPE (NORMAL BLOW, TIME DELAY, ETC.) ARE USED FOR REPLACEMENT. THE USE OF REPAIRED FUSES AND THE SHORT-CIRCUITING OF FUSE HOLDERS MUST BE AVOIDED.



59308A TIMING GENERATOR



8120-1378 DETACHABLE POWER CORD



10631A HP-IB INTERCONNECT CABLE

Figure 1-1. Model 59308A and Equipment Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This section provides general information on the HP 59308A Timing Generator including a general description, applications, instrument identification, equipment supplied and specifications.

1-3. On the title page of this manual, below the manual part number, is a microfiche part number. This number may be used to order 4x6-inch microfilm transparencies of the final manual. The microfiche package also incudes the latest Manual Changes supplement as well as all pertinent Service Notes.

1-4. DESCRIPTION

1-5. The HP 59308A Timing Generator provides a timing reference as either a Timer (digital delay generator) or a Pacer (precision time marker generator). In the Timer mode the 59308A provides a timing pulse a specified interval after the trigger is received. In the Pacer mode it provides a train of timing pulses of specified period on and after the receipt of a trigger. These timing pulses are output on rear-panel BNC connectors and signal the ASCII bus with appropriate signals. In this mode the instrument may be used as a precision sample rate generator, to trigger a voltmeter reading every 10 seconds. The timing can be set from either the front-panel thumbwheel switches, or remotely through the HP Interface Bus. These options, of local or remote control, allow the 59308A to be used in either HP Interface Bus (HP-IB) systems or in simple applications where timing pulses are needed.

1-6. When addressed to talk, the 59308A will output an 8-character word serially on the bus to report the number of timing pulses output since the last trigger was received.

1-7. When in the Bus Pacer mode (by means of rear-panel switch) the 59308A can operate in a controllerless system to control the timing intervals between data transfer on the bus.

1-8. APPLICATIONS

1-9. The 59308A provides timing pulses for a system of measuring instruments, printer and/or recorder, and a controller interconnected with the HP-IB. The 59308A can also be used in bench-top (controllerless) systems to control the data rate such as, for example, between a counter and a printer. Specific applications for the 59308A are as follows:

a. A precision sample trigger for counters such as the HP 5345A.

b. An External Gate driver for the HP 5345A to precisely control the gate time.

c. Control the Gate circuit of the HP 5345A, to check points in time on a waveform with various gate times. (Requires two 59308A's.)

d. A digital divider for signals in the 1 kHz to 10 MHz frequency range.

e. To gate a specified number of pulses through an external circuit.

f. Convert pulse generators to long repetition rate, short output pulse devices.

g. Use of service requesting (SRQ) to ask for the calculator's attention; calculator uses serial polling to identify source of SRQ.

h. A precision sample rate for controlling data rates in a counter-printer subsystem.

1-10. INSTRUMENT IDENTIFICATION

1-11. Each Hewlett-Packard instrument has a ten-character serial number (e.g., 0000A00000). The four-digit serial prefix identifies a group of identical instruments, and the five-digit suffix is a serial number unique to each instrument. If the serial prefix on your instrument is not on the title page of this manual, your instrument is different from this manual and a manual change sheet is included to describe the differences. If the manual change sheet is missing, request one from the nearest Hewlett-Packard Sales and Service Office listed at the back of this manual.

1-12. SPECIFICATIONS

1-13. Table 1-1 lists specifications for the 59308A.

Table 1-1. Specifications

POWER REQUIREMENTS

Line Voltage: 115 Vac or 230 Vac ±10%
Line Frequency: 50 to 400 Hz
Power Consumption: 10 VA max

OPERATIONAL REQUIREMENTS

Load on Bus: 3.3 mA per line
Handshake Cycle Time: 12 μs (max), typical 10.8 μs

ENVIRONMENTAL

Operating Temperature: 0°C to 50°C
Relative Humidity: 95% at 40°C

TIME BASE

Crystal Frequency: 10 MHz
Stability:
Aging Rate: 3 parts in 10^7/month
Temperature: ±5 parts in 10^6, 0°C to 50°C
Line Voltage: <±5 parts in 10^7 for 10% line variation
External Input:
Frequency: 1 kHz to 10 MHz. 1, 5, and 10 MHz are the only frequencies allowable if this input is used for external time base.
Input Impedance: 1 kΩ ±10% at 10 MHz
AC Coupled Voltage: 4V rms (max); 1V rms (min)

GENERAL

Output Pulses:
Rise Time: 50 ns
Fall Time: 50 ns
Pulse Width: 500 ns ±100 ns (500 ns switches)
Logic Levels:

	High	Low
TTL into 1 kΩ	4V	0V
TTL into 50Ω	1V	0V
ECL into 50Ω	0V	-2V

Pacer Mode:
Range: 1 μs to 999E8 μs
Output: Square wave or pulse, ECL and TTL
Trigger: Local or external
Accuracy: ± Jitter ± time base ± trigger delay
Jitter: ±100 ns (max). Jitter is defined as the variation in the period of the output pulse.
Timer Mode:
Range: 1 μs to 999E8 μs
Output: Square wave or pulse, ECL and TTL
Trigger: Local or external
Accuracy: ± Jitter ± time base error ± trigger delay
Programming Codes:
Time in microseconds: (±) DDD (E±) D (Bracketed entries are optional)

Function	ASCII	Octal	Decimal
Pacer	P	120	80
Timer	T	124	84
Trigger/Reset Command	R	122	82
Enable rear-panel trigger	U	125	85
Disable rear-panel trigger	A	101	65
Enable Service Request	S	123	83
Disable Service Request	D	104	68

Table 1-1. Specifications (cont'd.)

Interface Functions and Uses:
Listener: Receives programming codes.
Talker: Outputs totalized count or responds to serial poll with status byte.
Service Request: If enabled, indicates end of interval.
Remote-Local: Switches operation to/from front-panel controls and program codes.
Device Trigger: Starts time interval and reset counter.

Trigger Input (rear panel):
Input Impedance: 10 kΩ edge triggered
Level: 0.5V (switch in 1V position); 2V (switch in 4V position)
Maximum Amplitude: 5V
Minimum Pulse Width: 100 ns
Polarity: Positive or negative slope

Trigger Delay:
Rear-Panel Trigger: ±.5 μs delay ±500 ns jitter from 2 μs to 999 x 10^8 μs. 59308A will not respond to this trigger if a timing period is in progress.
Front-Panel Trigger: Trigger occurs 1 μs after release of pushbutton.
Remote Trigger: Within 1 μs after 59308A accepts Trigger Reset Command.
Jitter in Pacer Mode: ±100 ns after the first cycle.

REMOTE PROGRAMMING
Controls: All front-panel functions are programmable via the HP-IB.
Bus Functions: Acts as a listener or a talker (refer to Section III).

INTERNAL COUNTER
Internal 6-digit counter is incremented each time interval. Total count is output onto the Bus when the 59308A is addressed to Talk. Counter is cleared by Reset Command.

DIMENSIONS
Height: 4 inches (101 mm) including feet
Width: 8.38 inches (212.9 mm)
Depth: 11.6 inches (294.6 mm)
Rack Height: 3½ inches (88.9 mm); Half-width module
Net Weight: 4 lbs. 10 oz. (2.10 kg)
Shipping Weight: 8 lbs. 7 oz. (3.83 kg)

1-14. EQUIPMENT SUPPLIED

1-15. Table 1-2 lists the equipment supplied with the 59308A.

Table 1-2. Equipment Supplied

Description	HP Part Number
Detachable Power Cord 7½ ft. (229 cm)	8120-1378
HP-IB Interconnect Cable	10631A

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section contains information for unpacking, inspection, repacking, storage, and installation.

2-3. UNPACKING AND INSPECTION

2-4. If the shipping carton is damaged, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage. If the instrument is damaged or fails to meet electrical specifications, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately (offices are listed at the back of this manual). Retain the shipping carton and padding material for the carrier's inspection. The Sales and Service Office will arrange for the repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-5. STORAGE AND SHIPMENT

2-6. To protect the 59308A during storage or shipment, use good commercial packing methods. Reliable commercial packing and shipping companies have the facilities and materials to adequately repack an instrument.

NOTE

Before returning an instrument to Hewlett-Packard, contact the nearest Hewlett-Packard Sales and Service Office for instructions.

2-7. Conditions during storage and shipment should normally be limited as follows:

a. Maximum altitude: 25,000 feet
b. Minimum temperature: -40°F (-40°C)
c. Maximum temperature: +167°F (+75°C)

2-8. POWER REQUIREMENTS

2-9. The 59308A operates from either 115 or 230 volts, 50 to 400 Hz. Before applying power, the voltage selector switch within the power receptacle module on the rear panel of the 59308A must be set to the correct position (115 or 230) and the correct fuse (230 mA for 115V and 125 mA for 230V) must be installed.

SECTION III

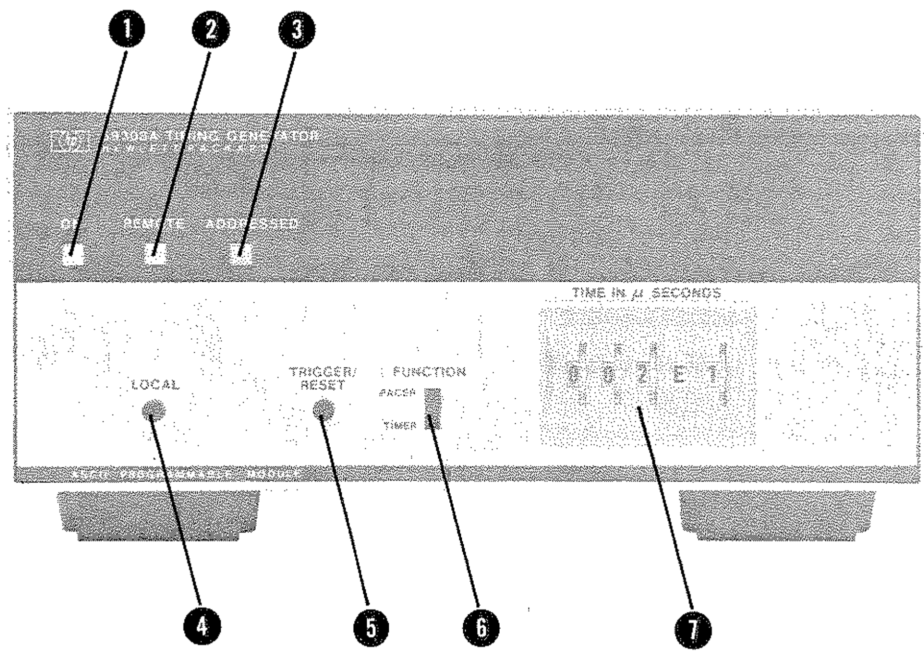
OPERATION AND PROGRAMMING

3-1. INTRODUCTION

3-2. This section contains operating information including a description of controls and indicators, operating procedures, and programming examples.

3-3. CONTROLS, INDICATORS, AND CONNECTORS

3-4. Figure 3-1 identifies and describes the front-panel controls and indicators. Figure 3-2 shows the rear-panel connectors and controls.



1. ON indicator: When illuminated, indicates instrument has primary power applied.
2. REMOTE indicator: When illuminated, indicates the 59308A is under remote operation and all front-panel controls are inoperative, except the LOCAL pushbutton (see NOTE in paragraph 3-17 for instructions on disabling the LOCAL pushbutton).
3. ADDRESSED indicator: When lighted, indicates the 59308A is addressed to talk or listen.
4. LOCAL pushbutton: When pushed, sets the 59308A to front-panel control provided the bus command Local Lockout (see paragraph 3-17) is not in effect.
5. TRIGGER/RESET pushbutton: When pushed, starts timing generator output and resets the output counter to zero; trigger time starts when the button is released.

Figure 3-1. 59308A Front Panel

6. FUNCTION switch: Local control that selects the PACER or TIMER function of the 59308A.

   a. PACER function: The 59308A outputs pulses or square waves on a continuing basis when and after the trigger occurs. The output pulse or square wave will have a period equal to the setting of the thumbwheel switch on the front panel.

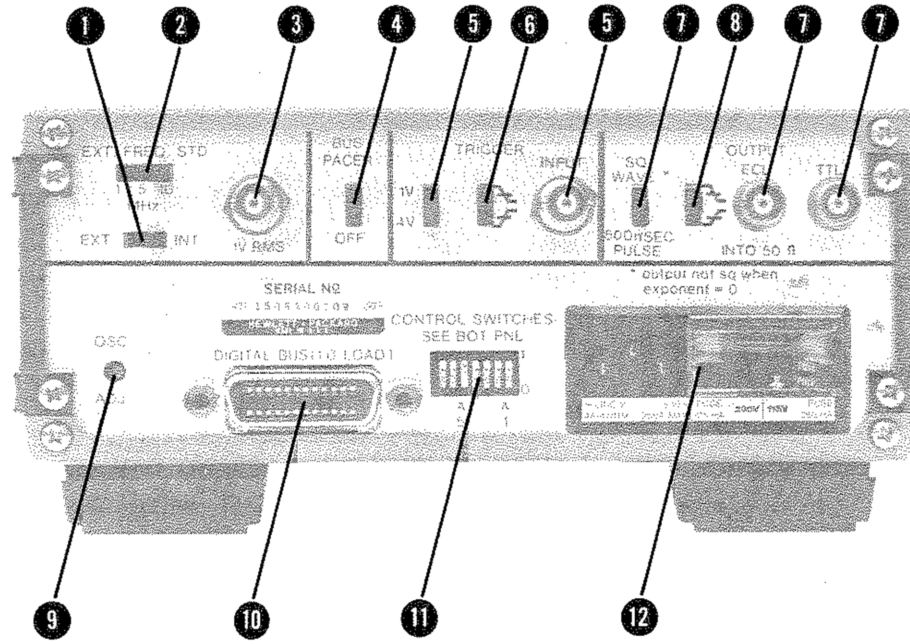
   b. TIMER function: The 59308A outputs one pulse or square wave after the trigger occurs. The delay of the pulse or square wave will be equal to the setting of the thumbwheel switch on the front panel.

7. TIME IN μ SECONDS switch: Thumbwheel switches that provide local control of time interval in microsecond steps from 001E0 to 999E8 μs. For examples see following:

Time Interval	**Thumbwheel Setting**
1 μs	001E0*
100 μs	100E0*
1 ms	001E3
100 ms	100E3
1 s	001E6
100 s	100E6
1 min	060E6
1 hour	036E8
1 day	864E8

*Square wave setting cannot be used if exponent is 0.

Figure 3-1. 59308A Front Panel (cont'd.)



1. EXT INT switch: When set to EXT, this switch disables the internal crystal oscillator and connects the signal present at the adjacent BNC connector as a frequency standard (time base). When set to INT, this switch selects an internal 10 MHz oscillator as a time base.

2. EXT FREQ STD switch: This switch is set to 1, 5, or 10 MHz to coincide with the frequency of the signal connected to the adjacent BNC.

3. 1V RMS: BNC connector accepts 1, 5, 10 MHz (switch selected) signal to replace the internal 10 MHz timebase.

4. BUS PACER (also referred to as BUS CONTROL) switch: When on, this switch causes the 59308A to control the time interval between the end of one data string and the beginning of the following data string on the Interface Bus. (For use in controllerless systems only.)

WARNING

SWITCH MUST BE SET TO "OFF" FOR OPERATION WITH CALCULATOR.

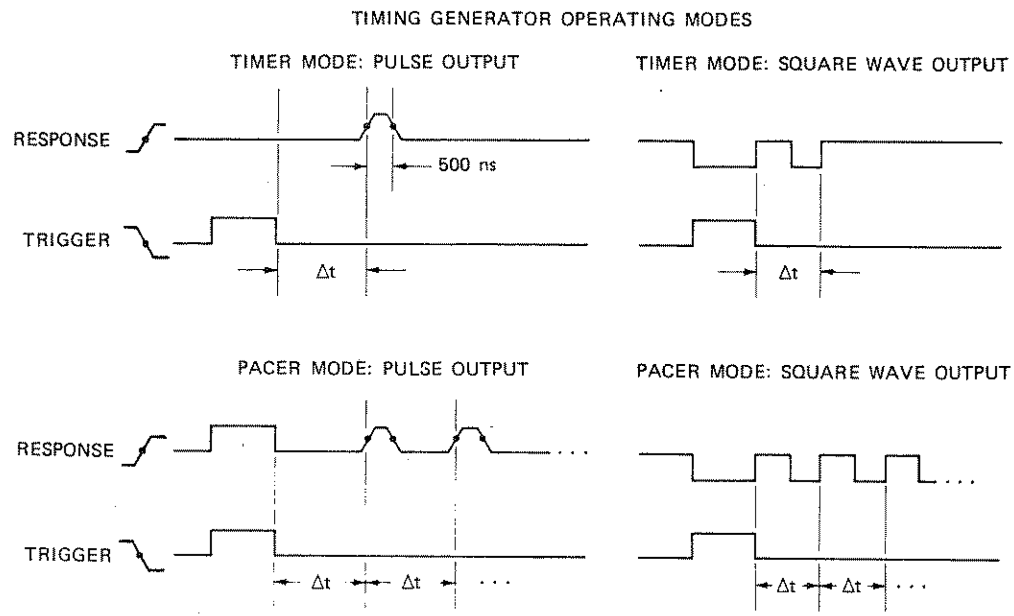
5. TRIGGER 1V–4V switch: Selects input voltage for BNC TRIGGER INPUT. The 1V position requires 0.5-volt (minimum) input. The 4V position requires 2-volt (minimum) input. Input triggering can be on either positive-going or negative-going edge.

6. TRIGGER ⎍ ⎍ switch: In ⎍ position, trigger will occur on positive-going edge of signal. In ⎍ position trigger will occur on negative-going edge of signal.

Figure 3-2. 59308A Rear Panel

7. OUTPUT SQ WAVE — 500n SEC PULSE switch: Provides selection of either a square-wave or a 500 ns pulse at the OUTPUT ECL and TTL connectors.

   a. SQ WAVE position: Provides a 50% duty cycle square-wave with a period equal to the setting of the thumbwheel switches. The square wave output in the timer mode is shown below:



NOTE

SQ WAVE setting cannot be used if the exponent thumbwheel (rightmost) is set to 0.

   b. 500n SEC position: Provides 500 ns pulse at intervals equal to setting of the thumbwheel switches. In the TIMER mode this pulse occurs once.

8. OUTPUT ⎍ ⎍ switch: In the ⎍ position, 59308A will output a positive-going edge after time interval. In ⎍ position, 59308A will output a negative-going edge after time interval.

9. OSC ADJ control: Recessed adjustment for adjusting the internal oscillator (time base).

10. DIGITAL BUS (1.0 LOAD) connector: 24-pin connector (12151-3283; Amphenol 57-2-240-2) mates with cable (HP 10631A/B/C) used to convey data and programming instructions to the 59308A. The "1.0 LOAD" label indicates that the instrument represents the normal allowable standard load for one instrument on the Interface Bus.

11. ADDRESS SWITCHES: These switches (A1–A5) are used to assign an address code to the 59308A. Switches A6 and A7 are not connected.

12. AC Power Module: Input power module consisting of an I.E.C. approved connector, a fuse, and a 115/230 line voltage switch. Design of module prevents fuse or switch change when ac power line is connected. The switch cannot be changed unless the fuse is removed. A 250 mA fuse is required for 115V input and a 125 mA fuse is required for 230V input.

Figure 3-2. 59380A Rear Panel (cont'd.)

3-5. TYPES OF OPERATION

3-6. The 59308A may be operated under local (front-panel) control or under remote (controller) programming control. All front-panel controls are programmable. The enable and disable functions of the rear-panel TRIGGER INPUT, SERIAL POLL, and SRQ are also programmable. Prior to performing the operating procedures, refer to the description of controls and indicators in Figures 3-1 and 3-2.

NOTE

> Prior to operating the 59308A, set the voltage selector switch in the ac power module (rear panel) to correspond with the line voltage to be used (115V or 230V). Install the correct line fuse (as labeled on the rear panel) and connect the 59308A to the power source. The ON indicator should illuminate.

3-7. OPERATION UNDER LOCAL CONTROL

3-8. The following paragraphs describe preliminary set-up procedures and methods of triggering used during local control.

3-9. Preliminary Set-up Procedures

3-10. Perform the following procedures (refer to Figure 3-1 for a description of front-panel controls and Figure 3-2 for a description of rear-panel controls):

a. On the 59308A front panel, press the LOCAL pushbutton.

b. Set the FUNCTION switch to PACER or TIMER, as required.

c. Set the TIME IN μSECONDS thumbwheel switch to the interval required.

d. On the rear panel, set the BUS PACER switch to OFF.

e. Set the INT EXT switch to INT to use the internal oscillator or to EXT to use an external frequency standard having a 1, 5 or 10 MHz output. (External frequency standard is connected to BNC connector adjacent to this switch.)

f. If INT EXT switch is set to EXT, set the EXT FREQ STD switch to 1, 5, or 10 MHz to correspond with the frequency of the external frequency standard.

g. Set the OUTPUT SQ WAVE — 500n SEC PULSE switch to select either a square wave for a 500 ns pulse output.

h. Set OUTPUT _/‾ ‾_ switch to _/‾ position to select a positive-going edge, or to ‾_ position to select a negative-going edge.

i. Connect cable to OUTPUT ECL or TTL connector. (Both connectors may be used at the same time.)

3-11. The preliminary set-up is now complete. To initiate the output, trigger the 59308A by one of the two methods described in the following paragraphs:

a. Front-panel TRIGGER/RESET pushbutton. Press and release this pushbutton. Trigger occurs on release of pushbutton.

b. Rear-panel TRIGGER connector. To use an external trigger, proceed as follows:

   1. Set the 1V–4V switch to correspond with either a 0.5-volt trigger source or a 2-volt trigger source.

   2. Set the TRIGGER _/‾ ‾_ switch to _/‾ position for the trigger to occur on the positive-going edge. Set to ‾_ position for the trigger to occur on the negative-going edge.

   3. Connect external trigger signal to TRIGGER INPUT connector.

3-12. OPERATION UNDER REMOTE CONTROL

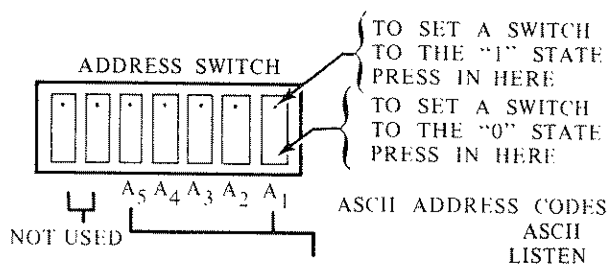
3-13. The following operating procedures are used when the 59308A is under HP-IB control. The procedures consist of preliminary set-up and programming procedures. Programming codes and a program example are also included.

3-14. Preliminary Set-up Procedures

3-15. The following procedures are used to prepare the 59308A for remote operation:

a. Select an address switch setting from Table 3-1 and set the address switches on the rear panel of the 59308A. Refer to Table 3-1 for instructions on setting the address switches. In general, any address switch setting is allowable except 11111 or an address already assigned to another talker or listener on the bus. (The addresses listed in Table 3-1 are also shown on the label located on the bottom cover of the 59308A.)

Table 3-1. Address Switch Settings



ASCII ADDRESS CODES

A_5	A_4	A_3	A_2	A_1	ASCII LISTEN ADDRESS	ASCII TALK ADDRESS
0	0	0	0	0	SP	@
0	0	0	0	1	!	A
0	0	0	1	0	"	B
0	0	0	1	1	#	C
0	0	1	0	0	$	D
0	0	1	0	1	%	E
0	0	1	1	0	&	F
0	0	1	1	1	'	G
0	1	0	0	0	(	H
0	1	0	0	1	)	I
0	1	0	1	0	*	J
0	1	0	1	1	+	K
0	1	1	0	0	,	L
0	1	1	0	1	-	M
0	1	1	1	0	.	N
0	1	1	1	1	/	O
1	0	0	0	0	Ø	P
1	0	0	0	1	1	Q
1	0	0	1	0	2	R
1	0	0	1	1	3	S
1	0	1	0	0	4	T
1	0	1	0	1	5	U
1	0	1	1	0	6	V
1	0	1	1	1	7	W
1	1	0	0	0	8	X
1	1	0	0	1	9	Y
1	1	0	1	0	:	Z
1	1	0	1	1	;	[
1	1	1	0	0	<	\
1	1	1	0	1	=	]
1	1	1	1	0	>	^
UNLISTEN					?	
UNTALK						_

b. On the rear panel of the 59308A set the BUS PACER switch to OFF.

c. Connect the 59308A into the system via the 10631 (A, B, or C) cable.

d. Set the INT EXT switch to INT to use the internal oscillator or to EXT to use an external frequency standard having 1, 5, or 10 MHz output. (External frequency standard is connected to BNC connector adjacent to this switch.)

e. If INT EXT switch is set to EXT, set the EXT FREQ STD switch to 1, 5, or 10 MHz to correspond with the frequency of the external frequency standard.

f. Set the SQ WAVE — 500n SEC switch to select either a square wave or 500 ns pulse output.

g. Set the _/‾ ‾_ switch to _/‾ position to select a positive-going edge or to ‾_ position to select a negative-going edge.

h. Connect a cable to the OUTPUT ECL or TTL connector as required. (Both connectors may be used at the same time.)

3-16. PROGRAMMING PROCEDURES

3-17. After performing the preliminary set-up procedures (paragraph 3-15), perform the following procedures to program the 59308A. The programming codes used to program the 59308A are listed in Table 3-2. Universal commands applicable to the 59308A are listed in Table 3-3.

a. Send the Untalk command (ASCII underscore "_" with ATN low) to ensure the 59308A will not output after being programmed. (Refer to paragraph 3-27.)

b. Send the Unlisten command (ASCII question mark "?" with ATN low) to ensure that only the 59308A will receive the programming codes.

c. Send the Remote Enable command (set REN low).

d. Send the listen address from Table 3-1 that corresponds to the address switches (as set in paragraph 3-15a). The ADDRESSED and REMOTE indicators should illuminate.

NOTE

To disable the LOCAL pushbutton, send the LOCAL LOCKOUT (LLO) universal command at this point. After receipt of LLO, the 59308A cannot be returned to local control, except on command from the bus. Send the Remote Disable command (set REN high) to clear LLO, enable the LOCAL switch and return the 59308A to local control. All programming codes are effective only if the 59308A is in remote operation. Steps e through h may be performed in any order.

e. Select the function by sending ASCII "P" (Pacer) or ASCII "T" (Timer).

f. Select the period of the output signal by sending three digits and "E" followed by another digit (see Table 3-3). The first three digits are the time digits and the fourth is the exponent. For example, 123E4 equals 123×10^4 μs.

g. If service requesting is desired (see paragraph 3-30 in this manual or for more complete explanation refer to HP INTERFACE BUS DIGITAL TIMING FAMILY TRAINING MANUAL, pages 19 and 20), send SRQ Enable code (ASCII "S"), otherwise send SRQ Disable code (ASCII "D").

h. If rear-panel (external) triggering is to be used, send Rear Panel Enable code (ASCII "A"), otherwise send Rear Panel Disable code (ASCII "U").

i. For triggering procedures, proceed to paragraph 3-18.

NOTE

Any succeeding programming sequence may omit steps e through h above. The previous value will remain in effect.

Table 3-2. 59308A Programming Codes

Function	ASCII	Binary DIO Lines 7 6 5 4 3 2 1	Octal	Decimal
MODE				
Pacer	P	1 0 1 0 0 0 0	120	80
Timer	T	1 0 1 0 1 0 0	124	84
TRIGGER				
Trigger/Reset	R	1 0 1 0 0 1 0	122	82
Disable Rear-Panel Trigger	U	1 0 1 0 1 0 1	125	85
Enable Rear-Panel Trigger	A	1 0 0 0 0 0 1	101	65
SERVICE REQUEST				
Enable Service Request	S	1 0 1 0 0 1 1	123	83
Disable Service Request	D	1 0 0 0 1 0 0	104	68
TIME				
Program in μseconds (±)DDD (E±) D from 001E0 to 999E8 Note: Bracketed entries are optional.	(See Time Digit Codes)			
TIME DIGIT CODE				
0	0	0 1 1 0 0 0 0	060	48
1	1	0 1 1 0 0 0 1	061	49
2	2	0 1 1 0 0 1 0	062	50
3	3	0 1 1 0 0 1 1	063	51
4	4	0 1 1 0 1 0 0	064	52
5	5	0 1 1 0 1 0 1	065	53
6	6	0 1 1 0 1 1 0	066	54
7	7	0 1 1 0 1 1 1	067	55
8	8	0 1 1 1 0 0 0	070	56
9	9	0 1 1 1 0 0 1	071	57
E	E	1 0 0 0 1 0 1	105	69
+	+	0 1 0 1 0 1 1	053	43
−	−	0 1 0 1 1 0 1	055	45
UNADDRESSED CODES				
Unlisten	?	0 1 1 1 1 1 1	077	63
Untalk	—	1 0 1 1 1 1 1	137	95
UNIVERSAL CODES (ATN must be low)				
Local Lockout (LLO)	DC1	0 0 1 0 0 0 1	021	17
Group Execute Trigger (GET)	BS	0 0 0 1 0 0 0	010	8
Serial Poll Enable (SPE)	CAN	0 0 1 1 0 0 0	030	24
Serial Poll Disable (SPD)	EM	0 0 1 1 0 0 1	031	25

Table 3-3. 59308A Code Summary

Signal/Code	Bus Lines Used	Remarks	59308A Response
Listen Address Codes	DIO ATN	See Table 3-1 for listing of listen addresses.	Illuminates ADDRESSED indicator. Sets 59308A to receive programming instructions.
Bus Clear (IFC)	IFC	Control line. Low state clears bus instruments.	Same action as Unlisten command.
Remote Enable (REN)	REN	Control line. Low state enables remote operation.	Illuminates the REMOTE indicator. Places 59308A in remote operation.
Remote Disable Command	REN	Control line. High state halts remote operation.	Extinguishes REMOTE indicator. Clears Local Lock-out and returns control to front panel.
Programming Instructions	DIO	See Table 3-2 for listing.	Programs the 59308A for remote operation.
UNIVERSAL COMMANDS			
DC1	DIO ATN	Local Lockout (LLO)	Disables the LOCAL push-button on the front panel.
BS	DIO ATN	Group Execute Trigger (GET)	Causes instruments on the bus (that are addressed to listen) to execute their function.
CAN	DIO ATN	Serial Poll Enable (SPE)	Controller places the bus in the serial polling mode.
EM	DIO ATN	Serial Poll Disable (SPD)	Controller terminates the serial polling mode.
?	DIO ATN	Unlisten	Clears or removes all addressed listeners from the active state of being addressed.
— (Underscore)	DIO ATN	Untalk	Underscore is used to clear the addressed talker from the active state of being addressed.

3-18. Remote Triggering

3-19. The 59308A may be triggered, in remote operation, by any one of three methods. Two of these methods require sending a trigger code on the interface bus, either the 59308A trigger command (R) or the universal command Group Execute Trigger (GET). The third method is by rear-panel triggering (from an external trigger source) which is controlled by codes on the interface bus for rear-panel trigger enable or rear-panel trigger disable. The three trigger methods may be used in any sequence or combination. The first

trigger received by the 59308A will initiate output. The 59308A will use the last trigger received as the reference from which to start timing.

NOTE

A trigger received during outputting will cause the 59308A to start a new output signal period. This will have the effect of extending the timing period that was in process when the trigger was received.

3-20. 59308A TRIGGER COMMAND. To trigger the 59308A by this method, send ASCII (R).

3-21. GROUP EXECUTE TRIGGER (GET). To trigger the 59308A by this method, send ASCII (BS).

3-22. REAR-PANEL TRIGGERING. To trigger from the rear panel:

a. Perform the set-up procedure in paragraph 3-11b.

b. Verify that the rear-panel trigger enable code (ASCII A) has been sent.

c. Apply the trigger signal.

3-23. Talk Function

3-24. When the 59308A is addressed to talk it will output an 8-character word serially on the interface bus. The output will indicate the number of timing periods that have occurred since the last trigger. The timing signal will continue to update while the 59308A is talking on the bus. The talk output on the bus DIO lines is shown in Table 3-4.

Table 3-4. Talk Function Format

Order Outputted	Character (ASCII)	Description
1	SP/O	O = overflow. More than 999999 timing periods have occurred since the last trigger.
2	SP	SP = Space
3-8	Ø-9	Any digit from Ø thru 9
9	CR	CR = Carriage return
1Ø	LF	LF = Linefeed

3-26. To Address to Talk the 59308A proceed as follows:

a. Send the Unlisten Command (ASCII ?) to keep the 59308A from "talking to itself". This step must be performed to ensure proper operation.

NOTE

Since the Unlisten Command unaddresses all listeners on the bus, the user may wish to address the listeners that are to receive data from the 59308A at this time.

b. Send the talk address from Table 3-1 that corresponds to the address switch setting (see paragraph 3-15a). The ADDRESSED indicator should illuminate.

c. The 59308A will automatically start outputting to any listener on the bus when the bus goes to the data mode (ATN high).

3-27. Unaddressing

3-28. Unaddressing is used to stop the 59308A from listening or talking on the bus. The Unlisten command stops the listening function and the Untalk command stops the talk function. Both talking and listening can be cleared by setting IFC low. Unaddressing is accomplished as follows:

a. Unlisten command. This command (ASCII question mark "?") is sent to the DIO lines (with ATN low) and causes the 59308A to stop listening. This command unaddresses all listeners on the bus but has no effect on bus talkers.

b. Untalk command. This command (ASCII underscore "_") is sent on the DIO lines (with ATN low) and causes the 59308A to stop talking. This command unaddresses all talkers on the bus but has no effect on bus listeners.

c. IFC. The IFC (Bus Clear) signal is implemented by setting the IFC line low for at least 100 μs. This action unconditionally unaddresses the 59308A, and halts all activity on the bus. This command is used by a controller to halt bus activity prior to taking control.

d. Automatic untalking. The 59308A will automatically unaddress itself as a talker whenever a talk address other than its own is sent on the bus.

3-29. SERVICE REQUESTING

3-30. Service requesting is enabled by sending the Service Request Enable code (ASCII S) to the 59308A during remote programming. When enabled by this code, the 59308A will service request at the end of the first timing period after a trigger is received. The service request is cleared by another trigger or by the universal command Serial Poll Enable (see paragraph 3-31). Service requesting is disabled by sending the Service Request Disable code (ASCII D) to the 59308A during remote programming.

3-31. SERIAL POLLING

3-32. The 59308A responds to the universal commands Serial Poll Enable (SPE) and Serial Poll Disable (SPD). To serial poll the 59308A:

a. Send the Serial Poll Enable universal command (ASCII CAN).

b. Send the 59308A talk address from Table 3-1 that corresponds to the address switch setting (see paragraph 3-15a).

NOTE

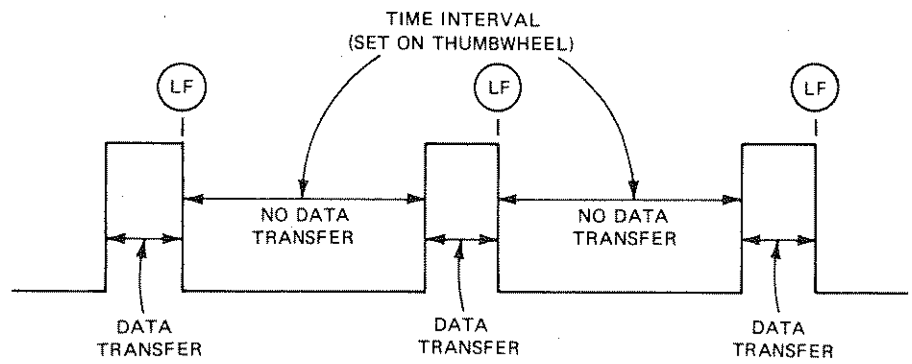
The 59308A will respond to SPE by clearing its service request and outputting a status byte (ASCII a) on the bus if it has service requested. (Refer to paragraph 3-30 for a description of service requesting.)

c. To terminate serial polling send the Serial Poll Disable universal command (ASCII BS).

3-33. CONTROLLERLESS SYSTEMS (BUS PACER MODE)

3-34. The 59308A can be used in controllerless systems to precisely control the data rate on the bus. For example, the 59308A can control the output rate from a counter to a printer. The 59308A is placed in this control mode by setting the BUS PACER switch (on the rear panel) to the ON position. In this mode, the 59308A will stop transfer of data on the bus by refusing to complete the "handshake" sequence (required for data transfer) for a specified time interval after receipt of a linefeed character. The time interval is specified

by the setting of the thumbwheels on the front panel of the 59308A. The data transfer time is determined by the speed of the slowest instrument on the bus. The timing diagram is shown below:



3-35. The preliminary set-up procedures given under paragraph 3-7 apply to the bus pacer mode. It is not recommended that the bus pacer mode be used if the 59308A is not to be used in the local control.

3-36. PROGRAMMING EXAMPLES

3-37. Following are four program examples using an HP 9820A or 9830A Calculator.

3-38. Program Example 1 Using a 9820/9821 Calculator

3-39. The following paragraphs describe an example of programming a 9820/9821 Calculator (used as a bus controller) to control the 59308A. The functions performed are as follows:

a. Program the 59308A in the pacer mode with an output signal period of 10 milliseconds.

b. Disable SRQ.

NOTE

It is assumed that a system including the 9820A Calculator, the ASCII Interface and Peripheral Control II, and the 59308A (with its address switches set to 10011) has been interconnected and prepared for operation. For detailed operating procedures, refer to Peripheral Control II operating manual, HP Part No. 09820-99024. Also refer to Hewlett-Packard Interface Bus Users Guide 9820A, 9821A.

3-40. LOADING THE PROGRAM. Prior to loading the program, push the END and EXECUTE keys. This positions the program counter to zero. Push the remaining keys to program the Calculator as shown in the following printer list:

9820A Calculator Program Printer List, Example 1

```
0:
CMD "?U3","P100E
2DR"⊢
1:
END ⊢
R424
```

3-41. VERIFYING THE PROGRAM. After the program has been loaded, push the END and LIST keys. This will run a printer list of the program. Check the list to verify that the program was entered correctly. A detailed program description is shown in Table 3-5.

3-42. RUNNING THE PROGRAM. To run the program push the END and RUN PROGRAM keys.

Table 3-5. 9820A Program Description, Example 1

Program Line No.	Commands	Description
Ø	CMD	Control statement. Refer to 11224A Peripheral Control II Operating Manual, HP Part No. 09820-99024, page 2-11.
Ø	"	First quotes following CMD statement specifies address mode.
Ø	?	Unaddresses all listeners on the bus.
Ø	U	Calculator talker address.
Ø	3	59308A listen address, commands 59308A to listen.
Ø	"	Terminates address mode.
Ø	,	Delimiter between modes (address and data).
Ø	"	Second quote field specifies data program mode.
Ø	P	Program code for 59308A Pacer Mode.
Ø	100E2	Output signal period (enter in μs) 100 x 10^2 μs = 10 milliseconds.
Ø	D	Service Request Disable.
Ø	R	Triggers the 59308A.
Ø	"	Terminates data mode.
1	END	Ends program.

3-43. Program Example 1 Using 9830A Calculator

3-44. The following paragraphs describe an example of programming a 9830A Calculator (used as a bus controller) to control the 59308A. The functions performed are as follows:

a. Program the 59308A in the Pacer mode with an output signal period of 10 milliseconds.

b. Disable SRQ.

NOTE

It is assumed that a system including the 9830A Calculator, the ASCII Interface Card, the 9866A Printer, the Extended I/O ROM, and the 59308A (with its address switches set to 10011) has been interconnected and prepared for operation. For detailed operating procedures, refer to 9830A Operating and Programming Manual, HP Part No. 09830-90001 and to the extended I/O ROM Operating Manual, HP Part No. 09830-90007. Also refer to Hewlett-Packard Interface Bus Users Guide, 9830A.

3-45. LOADING THE PROGRAM. Prior to loading the program, push the STOP key down until STOP appears on display. If display remains blank refer to the 9830A Operating and Programming Manual, Appendix A. Push the remaining keys to program the Calculator as shown in the following printer list:

9830A Calculator Program Printer List, Example 1

```
10 CMD "?U3","P100E2DR"
20 END
```

3-46. VERIFYING THE PROGRAM. After the program has been loaded, push the LIST and EXECUTE keys. This will run a printer list of the program. Check the list to verify that the program was entered correctly. A detailed program description is shown in Table 3-6.

3-47. RUNNING THE PROGRAM. To run the program push the RUN and EXECUTE keys.

Table 3-6. 9830A Program Description, Example 1

Program Line No.	Description
10	Unaddresses all listeners on the bus (?). Addresses the 9830A to talk (U) and 59308A to listen (3). Programs 59308A to Pacer mode (P). Sets timing period to 100 x 10^2 μs = 10 ms (100E2). Disables service request (D). Triggers the 59308A (R).
20	Ends program.

3-48. Program Example 2 Using 9820A Calculator

3-49. The following paragraphs describe an example of programming a 9820A Calculator (used as a bus controller) to control the 59308A. The functions performed are as follows:

a. Program the 59308A in the Timer mode with a time interval of 054 x 10^5 μs.

b. Serial poll the 59308A.

c. Set 59308A to the Pacer mode with an output signal period of 014 x 10^2 μs.

d. Program the 59308A to output on the bus.

e. Print the results of the serial polling and the 59308A bus output.

NOTE

It is assumed that a system including the 9820A Calculator, the ASCII Interface and Peripheral Control II, and the 59308A (with its address switches set to 10011) has been interconnected and prepared for operation. For detailed operating procedures, refer to Peripheral Control II operating manual, HP Part No. 09820-99024. Also refer to Hewlett-Packard Interface Bus Users Guide, 9820A.

3-50. LOADING THE PROGRAM. Prior to loading the program, push the END and EXECUTE keys. This positions the program counter to zero. Push the remaining keys to program the Calculator as shown in the following printer list:

9820A Calculator Program Printer List, Example 2

```
0:
CMD "?U3","T054E
5ASR"⊢
1:
IF RDS 13<1.9;
GTO 3⊢
2:
DSP "WAITING";
GTO 1⊢
3:
CMD "?*S5";PRT
RDB 13⊢
4:
CMD "Σ"⊢
5:
CMD "?U3","P014E
2DR"⊢
6:
CMD "?S5"⊢
7:
FMT *;RED 13,B⊢
8:
FXD 6.0;PRT B⊢
9:
END ⊢
```

```
64.000000
 5.000000
```

3-51. VERIFYING THE PROGRAM. After the program has been loaded, push the END and LIST keys. This will run a printer list of the program. Check the list to verify that the program was entered correctly. A detailed program description is shown in Table 3-7.

3-52. RUNNING THE PROGRAM. To run the program push the END and RUN PROGRAM keys. The printout should compare with the Calculator printout shown under paragraph 3-50.

Table 3-7. 9820A Program Description, Example 2

Program Line No.	Description
Ø	Unaddresses all listeners on the bus (?). Addresses the 9820A to talk (U) and 59308A to listen (3). Programs 59308A to Timer mode (T). Sets timing period to 054 x 10^5 μs. Disables rear-panel trigger (A). Enables service request (S). Triggers the 59308A (R).
1	Checks service request (SRQ) line and goes to line 3 if 59308A has sent SRQ.
2	Causes 9830A to display "WAITING" and goes back to line 1.
3	Unaddresses all listeners on the bus (?). Sends Serial Poll Enable (symbol occurs as a result of pressing RECORD button). Sets 59308A as a talker (S) and 9820A as a listener (5). 9820A listens and prints decimal equivalent of status byte (64).
4	Serial Poll Disable Command (symbol occurs as a result of pressing JUMP button).
5	Unaddresses all listeners on the bus (?). 9820A talk address (U), 59308A listen address (3). Pacer mode (P). Time interval set to 014 x 10^2 μs. Disable service request (D). Trigger 59308A (R).
6	Unaddresses all listeners on the bus (?). 59308A talk address (S), 9820A listen address (5).
7	Defines free-field format (FMT *). Reads data on the bus through the calculator interface card to the "B" register.
8	Defines fixed point format to be printed. Prints contents of the "B" register.

Calculator Printout

64.ØØØØØ	Decimal equivalent of ASCII @.
5.ØØØØØ	Equal to number of timing periods since last trigger. Note: This number may differ from calculator to calculator.

3-53. Program Example 2 Using 9830A Calculator

3-54. The following paragraphs describe an example of programming a 9830A Calculator (used as a bus controller) to control the 59308A. The functions performed are as follows:

a. Program the 59308A in the Timer mode with a time interval of 054 x 10^5 μs.

b. Serial poll the 59308A.

c. Set 59308A to the Pacer mode with an output signal period of 014 x 10^2 μs.

d. Program the 59308A to output on the bus.

e. Print the results of the serial polling and the 59308A bus output.

NOTE

It is assumed that a system including the 9830A Calculator, the ASCII Interface Card, the 9866A Printer, the Extended I/O ROM, and the 59308A (with its address switches set to 10011) has been interconnected and prepared for operation. For detailed operating procedures, refer to 9830A Operating and Programming Manual, HP Part No. 09830-90001 and to the Extended I/O ROM Operating Manual, HP Part No. 09830-90007. Also refer to Hewlett-Packard Interface Bus Users Guide, 9830A.

3-55. LOADING THE PROGRAM. Prior to loading the program, push the STOP key down until STOP appears on display. If display remains blank refer to the 9830A Operating and Programming Manual, Appendix A. Push the remaining keys to program the Calculator as shown in the following printer list:

9830A Calculator Program Printer List, Example 2

```
1 FORMAT B
10 CMD "?U3","T054E5USR"
20 IF STAT13 <= 1.9 THEN 50
30 DISP "WAITING"
40 GOTO 20
50 OUTPUT (13,1)256,24,63,83,53,512;
60 A=RBYTE13
70 PRINT A
80 OUTPUT (13,1)256,25,512;
90 CMD "?U3","P014E2DR"
100 CMD "?S5"
110 ENTER (13,*)B
120 PRINT B
130 END
```

```
64
4
```

3-56. VERIFYING THE PROGRAM. After the program has been loaded, push the LIST and EXECUTE keys. This will run a printer list of the program. Check the list to verify that the program was entered correctly. A detailed description is shown in Table 3-8.

3-57. RUNNING THE PROGRAM. To run the program push the RUN and EXECUTE keys. The printout should compare with the Calculator printout shown under paragraph 3-55.

Table 3-8. 9830A Program Description, Example 2

Program Line No.	Description
1	Format statement used by OUTPUT statements in lines 50 and 80. Refer to 9830A Operating and Programming Manual for detailed explanation.
10	Unaddresses all listeners on the bus (?). Addresses the 9830A to talk (U) and 59308A to listen (3). Programs 59308A to Timer mode (T). Sets timing period to 054 x 10^5 μs. Disables rear-panel trigger (U). Enables service request (S). Triggers the 59308A (R).
20	Checks service request (SRQ) line and goes to line 50 if 59308A has sent SRQ
30 & 40	Causes 9830A to display "WAITING" and go back to line 20.
50	Puts the Bus in the command mode (256), sends serial poll enable (24), unaddresses all listeners (63), addresses the 59308A to talk (83) and the 9830A to listen (53) and puts the bus in the data mode (512).
60 & 70	9830A stores byte of information received from 59308A in Register A and prints it out.
80	9830A ends serial poll mode by setting bus in command mode (256), sending serial poll disable (25) and setting bus in data mode.
90	Unaddresses all listeners on the bus (?). 9830A talk address (U), 59308A listen address (3). Pacer mode (P). Time interval set to 014 x 10^2 μs. Disable service request (D). Trigger 59308A (R).
100	Unaddresses all listeners on the bus (?). 59308A talk address (S), 9830A listen address (5).
110 &120	9830A stores data received from 59308A in B register and prints it out.

Calculator Printout

64.00000	Decimal equivalent of status code output by 59308A indicating it had set SRQ.
4.00000	Equal to number of timing periods since last trigger. Note: This number may differ from calculator to calculator.

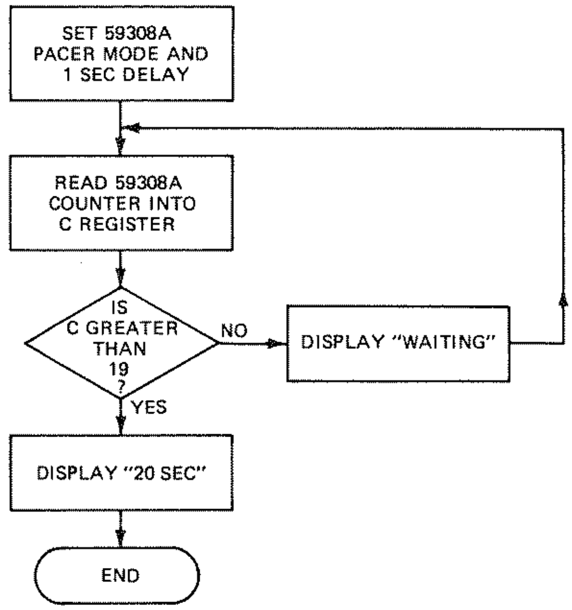
3-58. Program Example 3 Using 9820A Calculator

3-59. The following paragraphs describe an example of programming a 9820A Calculator (used as a bus controller) to control the 59308A. The functions performed are as follows:

a. Program the 59308A in the pacer mode to output pulses at 1 second intervals.

b. Accept contents of 59308A internal counter into Register "C", and if 20 seconds has elapsed, branch to a subroutine that displays the message "20 sec" otherwise, display the message "waiting".

Program Example 3 Flow Chart



NOTE

It is assumed that a system including the 9820A Calculator, the ASCII Interface and Peripheral Control II, and the 59308A (with its address switches set to 10011) has been interconnected and prepared for operation. For detailed operating procedures, refer to Peripheral Control II operating manual, HP Part No. 09820-99024.

3-60. LOADING THE PROGRAM. Prior to loading the program, push the END and EXECUTE keys. This positions the program counter to zero. Push the remaining keys to program the Calculator as shown in the following printer list:

9820A Calculator Program Printer List, Example 3

```
0:
CMD "?U3","P100E
4R"⊢
1:
CMD "?S5";FMT *;
RED 13,C⊢
2:
IF C>19;GTO 5⊢
3:
DSP "WAITING"⊢
4:
GTO 1⊢
5:
GSB "SEC"⊢
6:
GTO 9⊢
7:
"SEC";DSP "20 SE
C"⊢
8:
RET ⊢
9:
END ⊢
R412
```

3-61. VERIFYING THE PROGRAM. After the program has been loaded, push the END and LIST keys. This will run a printer list of the program. Check the list to verify that the program was entered correctly. A detailed program description is shown in Table 3-9.

3-62. RUNNING THE PROGRAM. To run the program push the END and RUN PROGRAM keys.

Table 3-9. 9820A Program Description, Example 3

Program Line No.	Description
Ø	Unaddresses all listeners on the bus (?). Addresses the 9820A to talk (U) and 59308A to listen (3). Programs 59308A to Pacer mode (P). Sets output signal period to 100 x 10^4 μs = 1 s. Triggers the 59308A (R).
1	Unaddresses all listeners on the bus (?). Addresses 59308A to talk (S). Addresses 9820A to listen (5). Format statement specifies the form of the data string the 59308A will output to the calculator (FMT *). Read statement and select code for bus I/O card (RED 13). Read 59308A output into register C (C).
2	If contents of calculator C register are greater than 19, go to line 5. (If C > 19:GTO 5)
3	Display "WAITING" on calculator readout. (DSP "WAITING".)
4	Go to line 1 (GTO 1).
5	Go to subroutine "sec" (line 7) (GSB "SEC").
6	Go to line 9 (GTO 9) (used second time thru subroutine to end program).
7	"SEC" subroutine causes 9820A to display "20 seconds" (DSP "20 SEC").
8	Return from subroutine to previous program (RET).
9	Ends Program (END).

3-63. Program Example 3 Using 9830A Calculator

3-64. The following paragraphs describe the programming of a 9830A Calculator to control the 59308A to perform program example 3. See paragraph 3-59a and b for a description and flow chart of the example 3 program. See example 2, 9830A for examples of loading, verifying, and running the program. Table 3-10 describes a detailed program for example 3.

9830A Calculator Program List, Example 3

```
10 CMD "?U3","P100E4R"
20 CMD "?S5"
30 ENTER (13,*)C
40 IF C>19 THEN 70
50 DISP "WAITING"
60 GOTO 30
70 GOSUB 90
80 GOTO 110
90 DISP "20 SEC"
100 RETURN
110 END
```

Table 3-10. 9830A Program Description, Example 3

Program Line No.	Description
1Ø	Unaddresses all listeners on the bus (?). Addresses 9830A to talk (U) and 59308A to listen (3). Programs 59308A to Pacer mode (P). Sets output signal period to 100 x 10^4 μs = 1 s. Triggers the 59308A (R).
2Ø	Unaddresses all listeners on the bus (?). Addresses 59308A to talk (S). Addresses 9830A to listen (5).
3Ø	9830A stores data received from 59308A counter in C register (ENTER (13,*) C).
4Ø	If contents of calculator C register are greater than 19, go to line 70 (If C > 19 THEN 70).
5Ø & 6Ø	Causes 9830A to display "WAITING" and go back to line 30.
7Ø	Go to subroutine on line 90.
8Ø	Go to line 110 (used second time thru subroutine to end program).
9Ø	Subroutine 20 sec. Causes 9830A to print "20 sec".
1ØØ	Terminates subroutine and goes to line 80.
11Ø	Ends program.

3-65. Program Example 4 Using 9820A Calculator

3-66. The following paragraphs describe an example of programming a 9820A Calculator (used as a bus controller) to control the 59308A. The functions performed are as follows:

a. Program the 59308A in the timer mode with a time interval output of 4 seconds.

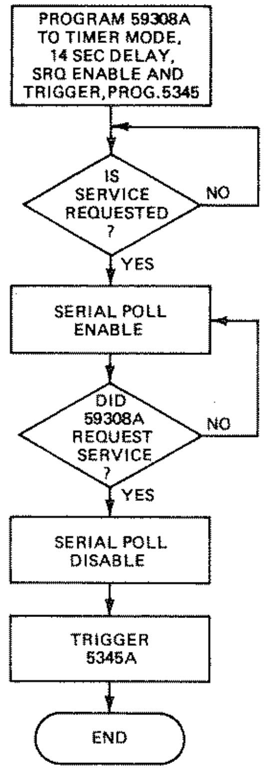
b. Enable 59308A Service Request (SRQ), trigger 59308A.

c. Program 5345A in Remote Program. Initialize mode with Local-Remote to Remote and Sample Rate to Hold.

d. Serial poll the bus to determine if 59308A has requested service.

e. If service has been requested by 59308A, trigger 5345A.

Program Example 4 Flow Chart



3-67. See Example 2, 9820A for examples of loading, verifying, and running the program. Table 3-11 describes a detailed program for example 4.

9820A Calculator Program List, Example 4

```
0:
CMD "?U3","T400E
4SR","?U6","I2E8
E9"⊢
1:
IF RDS 13<1;GTO
3⊢
2:
GTO 1⊢
3:
CMD "?→5X"⊢
4:
CMD "?S5";RDB 13
→A⊢
5:
IF A=64;GTO 7⊢
6:
GTO 4⊢
7:
CMD "?→X";CMD "?
U6","J1"⊢
8:
END ⊢
R411
```

Table 3-11. 9820A Program Description, Example 4

Program Line No.	Description
Ø	Unaddresses all listeners on the bus (?). Addresses 9820A to talk (U) and 59308A to listen (3). Programs 59308A to Timer mode (T). Sets timing period to 400 x 10^4 μs = 4 s. Enables 59308A service request (S). Triggers the 59308A (R). Unaddresses all listeners (?). Addresses 9820A to talk (U) and 5345A to listen (6). Sets 5345A to Remote Program Initialize (I2). (See 5345A Manual for initialize conditions.) Sets 5345A Local-Remote to Remote (E8). Sets 5345A Sample Rate to Hold (E9).
1	If SRQ has been requested go to line 3. RDS 13 is Read Status statement to check for presence of a service request. RDS 13 ≤ 1 checks if RDS 13 is equal to 1 or 0, both indicate that service has been requested; RDS 13 = 2 or 3 indicates service not requested.
2	Go to line 1 (GTO 1).
3	Command sequence to start a serial poll. Unaddresses all listeners on the bus (?). Untalk command (→) (underscore as used in quotes field). Listen address for calculator (5). Serial poll enable (use RECORD key for 9820A or DIAMOND key for 9821A).
4	Polls the devices on the bus. Unaddresses all listeners on the bus (?). Addresses the 59308A to talk (S). READ BYTE statement to read the status byte from the 59308A (RDB 13). →A designates the A register to contain the status byte.
5	Determines if 59308A has requested service and if so, goes to line 7. A = 64 denotes that 59308A has requested service.
6	Go to line 4.
7	Ends serial poll (? → serial poll disable command). Addresses 9820A to talk (U) and 5345A to listen (6). Instructs 5345A to leave the Sample Rate Hold phase of its operating cycle to make a measurement.

3-68. Program Example 4 Using 9830A Calculator

3-69. The following paragraphs describe an example of programming a 9830A Calculator to control the 59308A to perform program example 4. See paragraph 3-66a through e for a description of the functions performed and a flow chart of the example 4 program. See Example 2, 9830A for examples of loading, verifying, and running the program. Table 3-12 describes an example of programming a 9830A Calculator for example 4.

9830A Calculator Program List, Example 4

```
10 CMD "?U3","T400E4SR","?U6","I2E8E9"
20 IF STAT13 <= 1 THEN 40
30 GOTO 20
40 CMD "?U"
50 FORMAT 5B
60 OUTPUT (13,50)256,95,53,24,512;
70 CMD "?S5"
80 A=RBYTE13
90 IF A=64 THEN 110
100 GOTO 70
110 CMD "?U"
120 FORMAT 3B
130 OUTPUT (13,120)256,25,512;
140 CMD "?U6","J1"
150 END
```

Table 3-12. Programming 9830A Calculator, Example 4

Program Line No.	Description
10	Unaddresses all listeners on the bus (?). Addresses 9830A to talk (U) and 59308A to listen (3). Programs 59308A to Timer mode (T). Sets timing period to 400 x 10^4 μs = 4 s. Enables 59308A service request (S). Triggers the 59308A (R). Unaddresses all listeners (?). Addresses 9830A to talk (U) and 5345A to listen (6). Sets 5345A to Remote Program Initialize (I2). (See 5345A Manual for initialize conditions.) Sets 5345A Local-Remote to Remote (E8). Sets 5345A Sample Rate to Hold (E9).
20	If SRQ has been requested, go to line 40. STAT 13 is Status Function to check for presence of a service request. STAT 13 <= 1 checks if STAT 13 is equal to 1 or 0, both indicate that service has been requested; STAT 13 = 2 or 3 indicates service not requested.
30	Go to line 20.
40,50,60	Starts a Serial Poll. The CMD statement addresses the calculator to talk so that the calculator can execute the OUTPUT statement. The OUTPUT statement issues the untalk command, addresses the calculator to listen, then sets the serial poll mode.
70,80	Polls the devices on the bus. Unaddresses all listeners on the bus (?). Addresses the 59308A to talk (S). Listen address for calculator (5). (R BYTE) function reads the status byte the 59308A will output, the (13) is the select code of the I/O card. (A) designates the A register to contain the status byte.
90	Determines if 59308A has requested service and if so, go to line 110. A = 64 denotes that 59308A has requested service.
100	Go to line 70
110,120,130	Ends serial poll.
140	Unaddresses all listeners (?). Addresses 9830A to talk (U) and 5345A to listen (6). Instructs 5345A to leave the Sample Rate Hold phase of its operating cycle to make a measurement.

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION

4-2. This section explains the operation of integrated circuits and the overall functional description for the 59308A Timing Generator. Detailed circuit theory is provided accompanying the applicable schematic diagram in Section VIII.

4-3. INTEGRATED CIRCUIT OPERATION

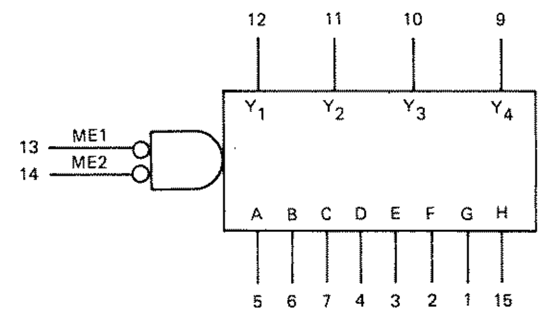
4-4. The following paragraphs describe fifteen of the IC's used in the 59308A. The remaining IC's that are used are common gates and flip-flops which can be found in standard text books or IC catalogs.

4-5. 1025-bit Read-only-memory, 1816-0350.

4-6. The read-only-memory (ROM) illustrated in Figure 4-1 is a 1024-bit ROM whose output is organized into 256 words by four bits. An 8-bit code is used to select the desired output word. The four outputs are open-collector which permit "AND" tying of the outputs to the same line. Logic lows are required at inputs ME1 and ME2 to activate the ROM.

4-7. 256-bit Read-only-memory, 1816-0351.

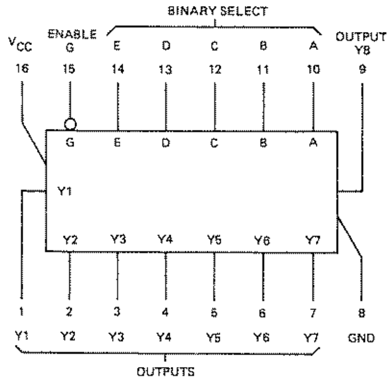
4-8. The read-only-memory shown in Figure 4-2 is a 256-bit ROM whose output is organized into 32 words by 8 bits. A 5-bit code is used to select the desired output word. The eight outputs are open collector which permit "AND" tying of the outputs to the same line. A logic low is required at the enable input to activate the ROM.



MRE	Inputs DIO Lines (ASCII Equivalent)	Output Pins 9	10	11	12
H	0 through 9	L	L	L	H
H	U,A	L	H	L	H
H	D,S	L	L	H	H
H	P,T	L	L	H	L
H	R	L	H	L	L
L	Local Lockout (DC1)	H	H	L	L
L	Serial Poll Enable (CAN)	H	H	L	H
L	Serial Poll Disable (EM)	H	H	H	L
L	Group Execute Trigger (BS)	H	L	H	H
L	All Listen Addresses	H	H	H	H
L	All Talk Addresses	L	H	H	H
L	Unlisten Command (?)	H	L	H	H
L	Untalk Command (_)	L	H	H	H

H = High Voltage Level, L = Low Voltage Level

Figure 4-1. 1024-bit Read-only-memory (1816-0350/ROM)



Order Outputted	ASCII Character	Input Pins					Output Pins							
		10	11	12	13	14	1	2	3	4	5	6	7	9
1*	O	H	H	H	L	L	H	H	H	H	L	L	H	H
1	SP	H	H	H	L	H	L	L	L	L	L	H	L	H
2	SP	L	H	H	L	H	L	L	L	L	L	H	L	L
3	Digit	H	L	H	L	H	C	C	C	C	H	H	L	L
4	Digit	L	L	H	L	H	C	C	C	C	H	H	L	L
5	Digit	H	H	L	L	H	C	C	C	C	H	H	L	L
6	Digit	L	H	L	L	H	C	C	C	C	H	H	L	L
7	Digit	H	L	L	L	H	C	C	C	C	H	H	L	L
8	Digit	L	L	L	L	H	C	C	C	C	H	H	L	L
9	CR	H	H	H	H	H	H	L	H	H	L	L	L	L
10	LF	L	H	H	H	H	L	H	L	H	L	L	L	L

*Letter O is outputted as the first character when an overflow condition exists.

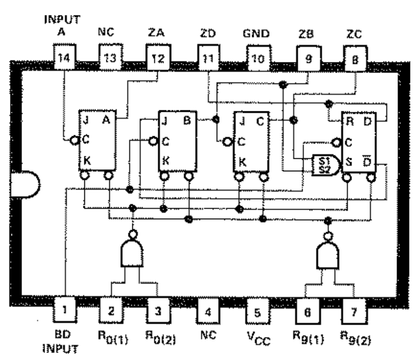
C = Output controlled by Output Counter U11.

H = High Level; L = Low Level

Figure 4-2. 256-bit Read-only-memory (1816-0351/ROM)

4-9. Decade Counters, 1820-0055 and 1820-0600

4-10. The decade counter symbol is shown in Figure 4-3. These counters contain four master slave flip-flops and additional gating to provide a divide-by-two counter and three-stage binary counter for which the count cycle length is divide-by-five. These counters have a gated zero reset and also have gated set-to-nine inputs. The 59308A uses the 1820-0600 connected as a counter and the 1820-0055 connected as a divider for the oscillator circuit.



TRUTH TABLES

BCD COUNT SEQUENCE (SEE NOTE 1)

COUNT	OUTPUT			
	Z_A	Z_B	Z_C	Z_D
0	L	L	L	L
1	H	L	L	L
2	L	H	L	L
3	H	H	L	L
4	L	L	H	L
5	H	L	H	L
6	L	H	H	L
7	H	H	H	L
8	L	L	L	H
9	H	L	L	H

RESET/COUNT (SEE NOTE 2)

RESET INPUTS				OUTPUT
$R_{0(1)}$	$R_{0(2)}$	$R_{9(1)}$	$R_{9(2)}$	D C B A
1	1	0	X	0 0 0 0
1	1	X	0	0 0 0 0
X	X	1	1	1 0 0 1
X	0	X	0	COUNT
0	X	0	X	COUNT
0	X	X	0	COUNT
X	0	0	X	COUNT

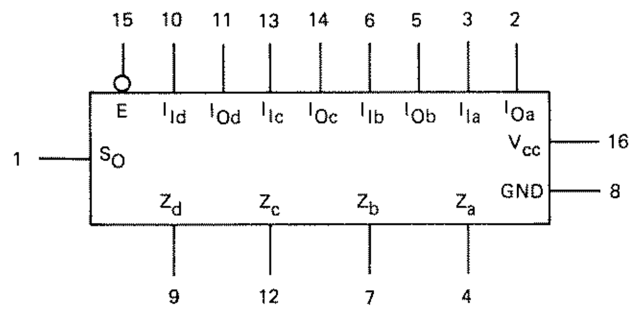
NOTES

1. Output A connected to input BD for BCD count.
2. X indicates that either a logical 1 or a logical 0 may be present.

Figure 4-3. Decade Counter (1820-0055 and 1820-0600)

4-11. Quad Two-Input Multiplexer, 1820-0616 or 1820-0710

4-12. The quad two-input multiplexer shown in Figure 4-4 consists of four multiplexing circuits with common select and enable logic. The enable input ($\overline{E}$) is active low. When not activated all outputs (Z) are low regardless of all other inputs. The quad two-input multiplexer is the logical implementation of a four-pole two position switch, with the position of the switch being set by the logic level supplied to the one select input.



TRUTH TABLE

ENABLE	SELECT INPUT	INPUTS		OUTPUT
$\overline{E}$	S_0	I_{0Y}	I_{1Y}	Z_Y
H	X	X	X	L
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

H = HIGH VOLTAGE LEVEL   Y = a,b,c,d
L = LOW VOLTAGE LEVEL
X = LEVEL DOES NOT AFFECT OUTPUT

Figure 4-4. Quad Two-Input Multiplexer (1820-0616 or 1820-0710)

4-13. 6-decade Counter, 1820-0634

CAUTION

This counter is a large-scale MOS integrated circuit. Its inputs are susceptible to damage by high voltage (+5.6 volts) and static charges. Particular care should be exercised when servicing this circuit or handling it under conditions where static charges can build up.

4-14. This circuit consists of six decade-counting elements, an overflow register, a 25-bit latch and output multiplexing circuits as shown in Figure 4-5. The counter can accumulate and store up to 1 million pulses at its input. The input triggers on the positive-going edge of the input pulse. The transfer input at pin 4 transfers data from the decade counters to the latch circuits when the transfer line is low. When the transfer line is high, data is stored in the latch circuits. The reset input at pin 11, resets the decades when the reset signal is high. One million or more input counts into the counter sets the overflow register, which causes the overflow output at pin 7 to go high following a transfer signal.

4-15. The counter output is available one digit at a time as a four-bit binary-coded-decimal signal (logical 1 is high). The digit selected at the output is determined by the binary-coded digit-select code at pins 8, 9, and 10. Binary 0 (all low) selects the least significant decade. Binary 5 selects the most significant decade in the register. A select code of binary 7 will set all outputs high.

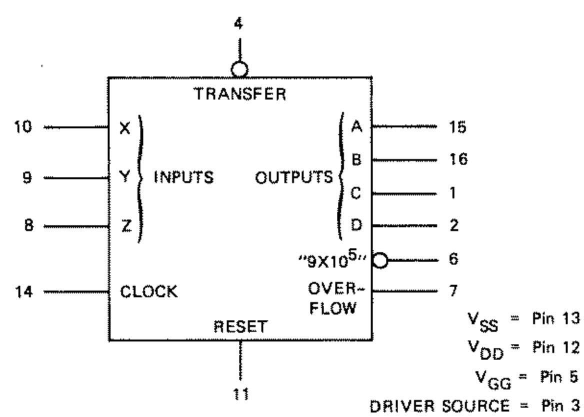
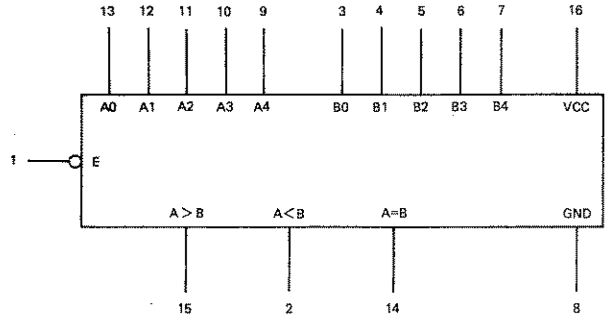


Figure 4-5. 6-decade Counter (1820-0634)

4-16. Low Power TTL 5-Bit Comparator, 1820-0904

4-17. This IC (Figure 4-6) provides a comparison between two 5-bit words and gives one of three outputs: "less than", "greater than", or "equal to". A high level on the enable input forces all three outputs low. A low on the enable input allows a comparison to take place. The comparator function is shown in Figure 4-6.



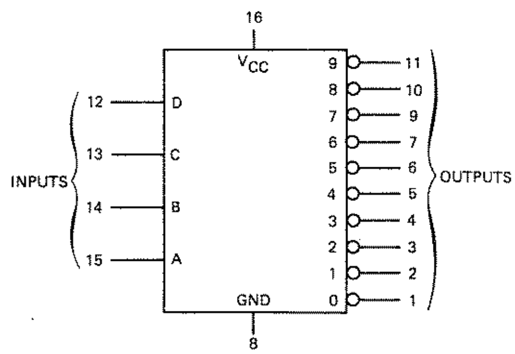
E	A B	A<B	A>B	A=B
H	X X	L	L	L
L	Word A = Word B	L	L	H
L	Word A > Word B	L	H	L
L	Word A < Word B	H	L	L

L = LOW Voltage Level
H = HIGH Voltage Level
X = Either HIGH or LOW Voltage Level

Figure 4-6. 5-Bit Comparator (1820-0904)

4-18. 1 of 10 Decoder, 1820-1047 (U19 and U20)

4-19. This decoder circuit (Figure 4-7) is a 4-line to 10-line decoder (1 of 10). The decoder consists of eight inverters and ten four-input "NAND" gates. The inverters are connected in pairs to make BCD input data available for decoding by the "NAND" gates.



Inputs (DIO Lines) ASCII Equivalent	Input Pins 12	13	14	15	Output Pins*
	U20				
Function (P or T) Code	H	L	H	L	3 High.
Timing Period (date) Code	H	L	L	H	2 High.
Service Request Codes	H	L	H	H	4 High.
Trigger/Reset Code	H	H	L	L	5 High.
Rear-Panel Trigger Code	H	H	L	H	6 High.
	U19				
Local Lockout (LLO) Code	H	L	L	L	1 High.
Serial Poll Enable Code	H	L	L	H	2 High.
Serial Poll Disable Code	H	L	H	L	3 High.
Listen Address (Remote Clock)	H	H	H	H	9 High.

*Note: Using 10525T Logic Probe, these pins blink low (active) when DAV occurs.

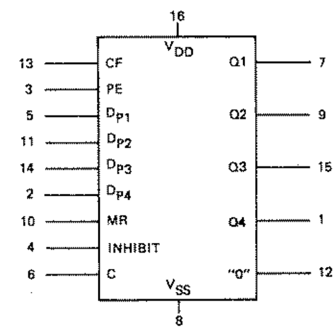
Figure 4-7. 1 of 10 Decoder (1820-1047)

4-20. Programmable Divide-by-N 4-bit Counters, 1820-1175 and 1820-1181

CAUTION

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is recommended that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

4-21. These CMOS counters (Figure 4-8) are programmable, cascadable down-counters with a decoded "O" state output for divide-by-N applications. In single stage applications the "O" output is applied to the Preset Enable (PE) input. In cascade operations, the Cascade Feedback (CF) input allows cascade divide-by-N operation with no additional gates required. The Master Reset (MR) function provides synchronous initiation of divide-by-N cycles. The Clock Inhibit input allows disabling of the pulse counting function. In the 59308A, counter U43 is an 1820-1181 and U44 and U45 art 1820-1175's. The 1820-1181 cannot be replaced by the 1820-1175. A TTL logic clip or probe cannot be used on this circuit.



COUNT	OUTPUT Q4	Q3	Q2	Q1
9	1	0	0	1
8	1	0	0	0
7	0	1	1	1
6	0	1	1	0
5	0	1	0	1
4	0	1	0	0
3	0	0	1	1
2	0	0	1	0
1	0	0	0	1
0	0	0	0	0

D_{P1} to D_{P4} are divide-by-N inputs.

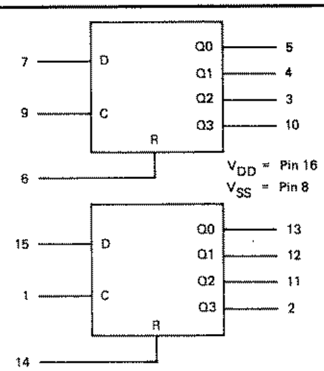
Figure 4-8. Programmable Divide-by-N 4-bit Counter (1820-1175 and 1820-1181)

4-22. Dual 4-bit Static Shift Register, 1820-1176

CAUTION

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields; however, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

4-23. This CMOS shift register (Figure 4-9) consists of two identical, independent 4-stage serial-input/parallel-output registers. Each register has independent Clock and Reset inputs with a single serial Data input. The register stages are type D master-slave flip-flops. Data is shifted from one stage to the next during the positive-going clock transition. Each register can be cleared when a high level is applied on the Reset line.



Truth Table

D	Q_n	Q_{n+1}
0	0	0
0	1	0
1	0	1
1	1	1

$Q_{n+1} = D_n$, R = 0

Figure 4-9. Dual 4-bit Static Shift Register (1820-1176)

4-24. Counter Time-Base Circuit, 1820-1180

CAUTION

This counter is a large-scale MOS integrated circuit. Its inputs are susceptible to damage by high voltage (+5.6 volts) and static charges. Particular care should be exercised when servicing this circuit or handling it under conditions where static charges can build up.

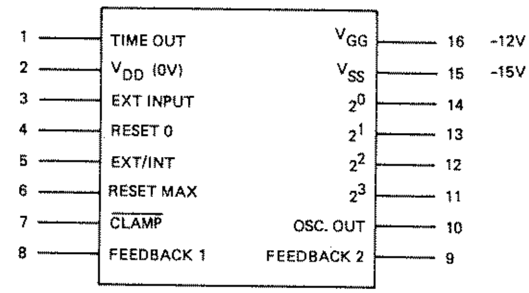


Figure 4-10. Counter Time-Base Circuit (1820-1180)

4-25. The counter time-base circuit (Figure 4-10) is an oscillator and divider chain circuit connected as a presettable counter. The circuit operates with an externally applied TTL signal as a frequency source. The time-base output (TIME OUT) is a square wave, its frequency determined by the selected counter division, and by the frequency of the external input.

4-26. OVERALL FUNCTION DESCRIPTION

4-27. The following paragraphs describe the overall function of the 59308A to the block diagram level. For a detailed description of the major circuits of the 59308A, refer to the schematic diagrams in Section VIII.

4-28. Local Operation

4-29. In local operation (see Figure 4-11), the Bus Communicator and Programming circuits process function information (from the PACER-TIMER switch on the front panel) in addition to the trigger pulse (from the TRIGGER/RESET button on the front panel). The processed information is sent to the Time Base and Divider circuits.

4-30. On receipt of a trigger pulse (from either the TRIGGER/RESET button or the rear-panel TRIGGER input) the Time Base and Divider circuits process the following:

a. The function (pacer-timer) signal from the Bus Communicator and Programming Circuits.

b. The 1 MHz signal from the Oscillator and Divider circuits.

c. The BCD codes from the thumbwheels on the front panel.

d. The levels from the output signal control switches and the trigger control switches on the rear panel.

e. The output timing signal to the ECL and TTL connectors on the rear panel.

4-31. Remote Operation (Listening)

4-32. In the listening mode (see Figure 4-12), the Bus Communicator and Programming circuits interface the 59308A with the bus and process and store remote programming codes. The circuit outputs the

programming information (Trigger command, function code, timing period data and rear-panel trigger enable or disable) to the Time Base and Divider circuits. In addition, this circuit controls the REMOTE and ADDRESSED indicators.

4-33. On receipt of a trigger pulse (from either a programmed Trigger command or the rear-panel TRIGGER input) the Time Base and Divider circuits process the following:

a. All programming information from the Bus Communicator and Programming circuits.

b. The 1 MHz signal from the Oscillator and Divider circuits.

c. The levels from the output signal control switches and the trigger control switches on the rear panel.

d. The output timing signal to the ECL and TTL connectors on the rear panel.

4-34. Remote Operation (Talking)

4-35. In the talking mode (see Figure 4-13), the Bus Communicator and Programming circuits interface the 59308A to the bus and process the talk address and the universal commands Serial Poll Enable (SPE) and Serial Poll Disable (SPD). After processing, the information is output to the Output and Status Poll circuits.

4-36. The Output and Status Poll circuits accumulate the number of timing periods that have occurred since the last trigger by counting the pulses on the Pulse line. This circuit outputs the count information on the bus DIO lines in response to serial polling and Service Request Enable (SRQE). The Output and Status Poll circuits will not output on the bus unless the enable signals are received from the Bus Communicator and Programming circuits. The output can drive the DAV, the DIO1-DIO7 and the SRQ lines on the bus.

4-37. Bus Pacer Operation

4-38. In bus pacer operation (see Figure 4-14), the Bus Communicator and Programming circuits perform in the same manner as in local operation, with the additional function of detecting the ASCII linefeed character. The ASCII LF is used (in place of the TRIGGER/RESET button) as the trigger signal to the Time Base and Divider circuits.

4-39. The LF trigger signal starts a time interval between data transfers on the bus. The length of the time interval is determined by the thumbwheel setting. The data transfer time is determined by the speed of the instruments on the bus as described in paragraph 3-34.

4-40. The Time Base and Divider circuits process the information from the Bus Communicator and Programming circuits, and from the thumbwheels and the BUS PACER switch to generate the Handshake Holdoff signal. The Bus Communicator circuits hold up bus activity whenever the Handshake Holdoff signal is present.

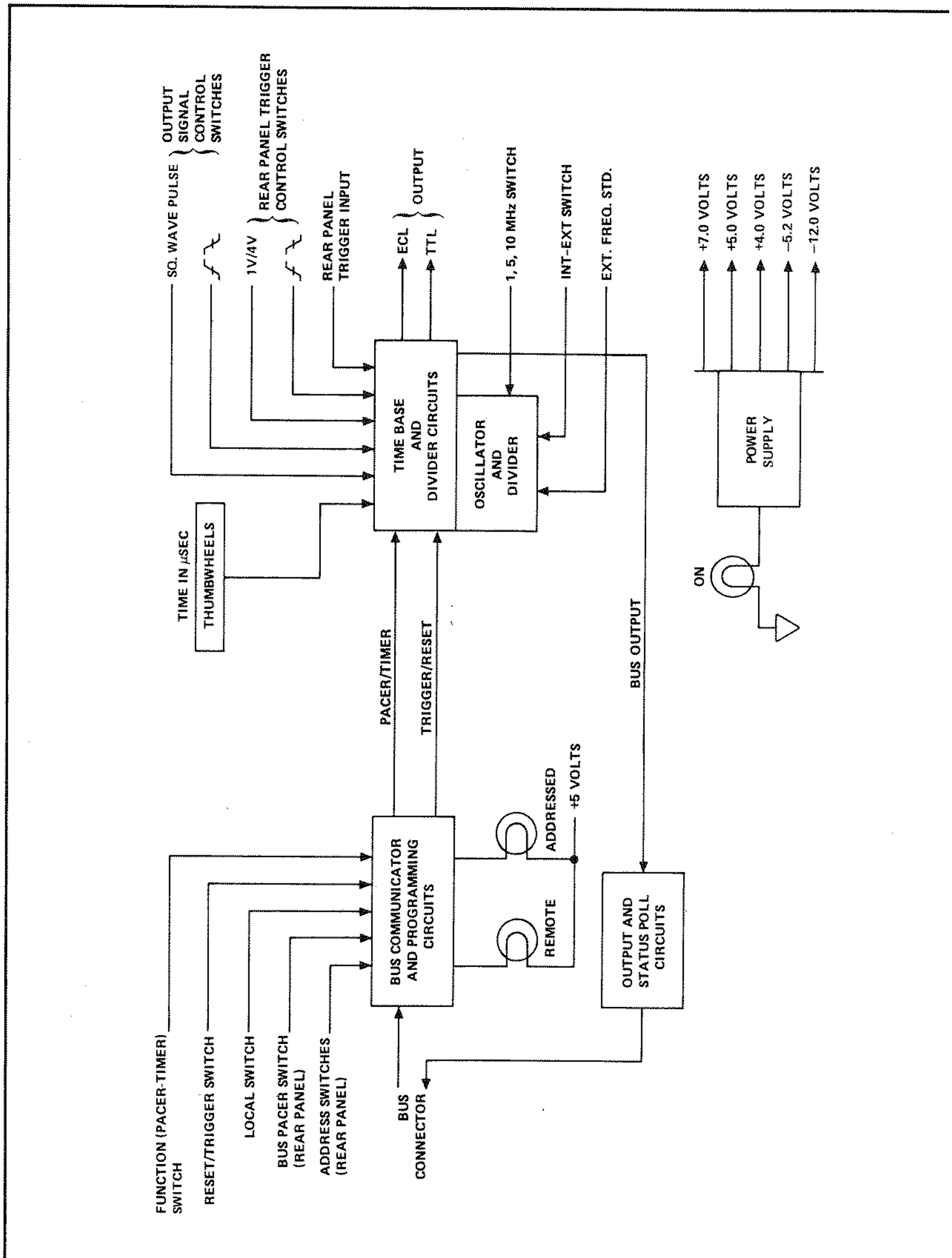


Figure 4-11. Local Operation Block Diagram

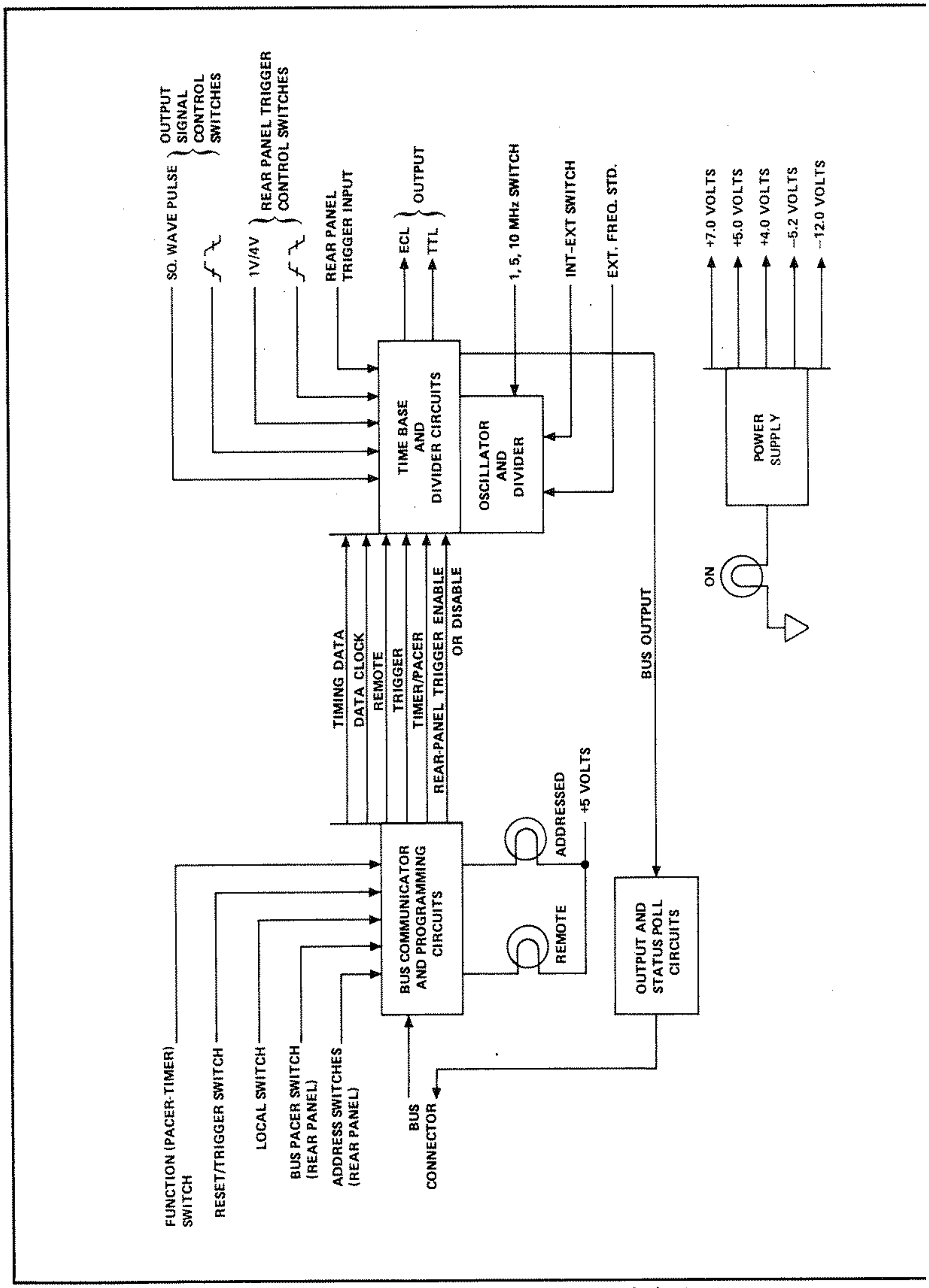


Figure 4-12. Remote Operation (Listening) Block Diagram

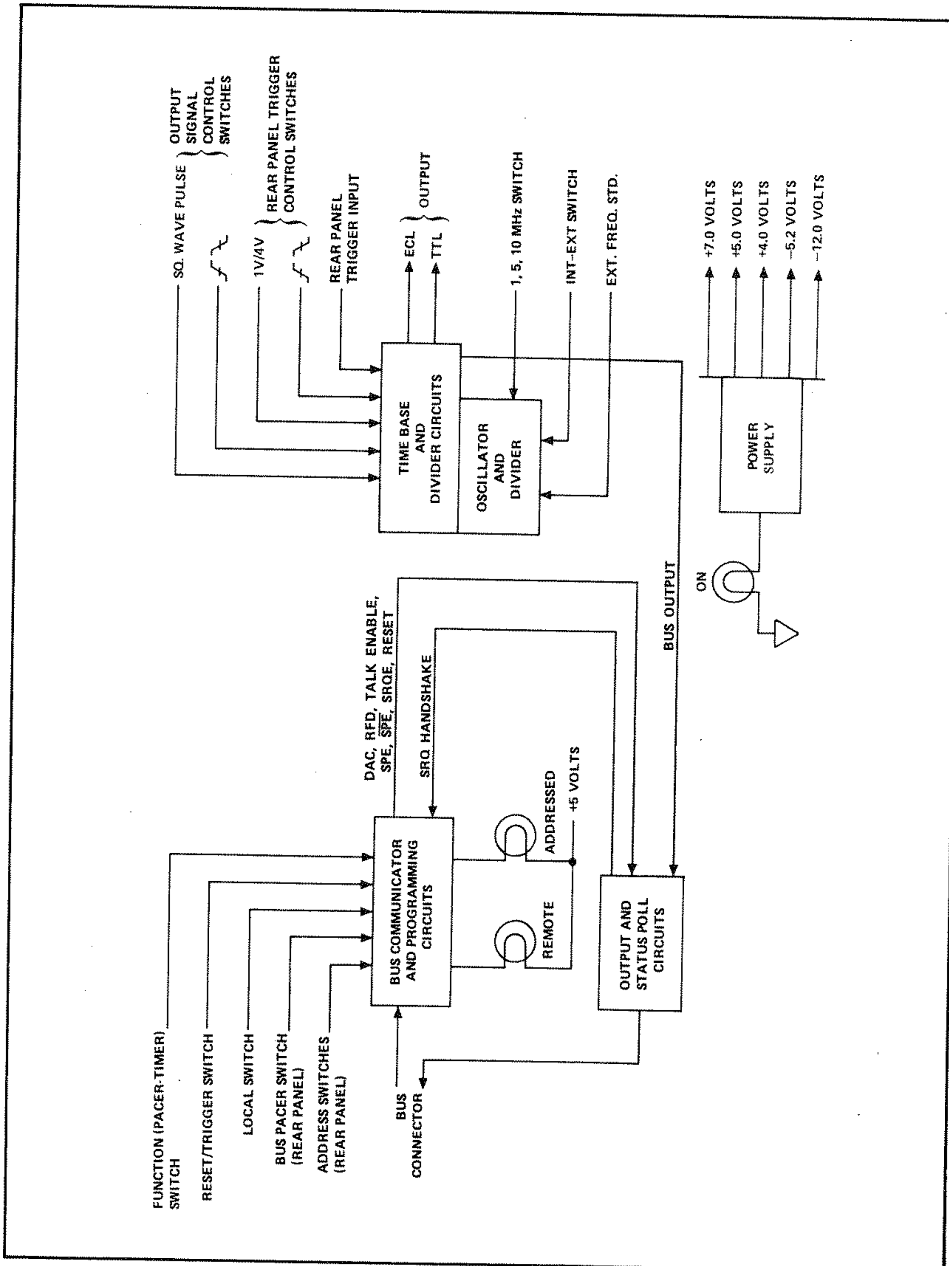


Figure 4-13. Remote Operation (Talking) Block Diagram

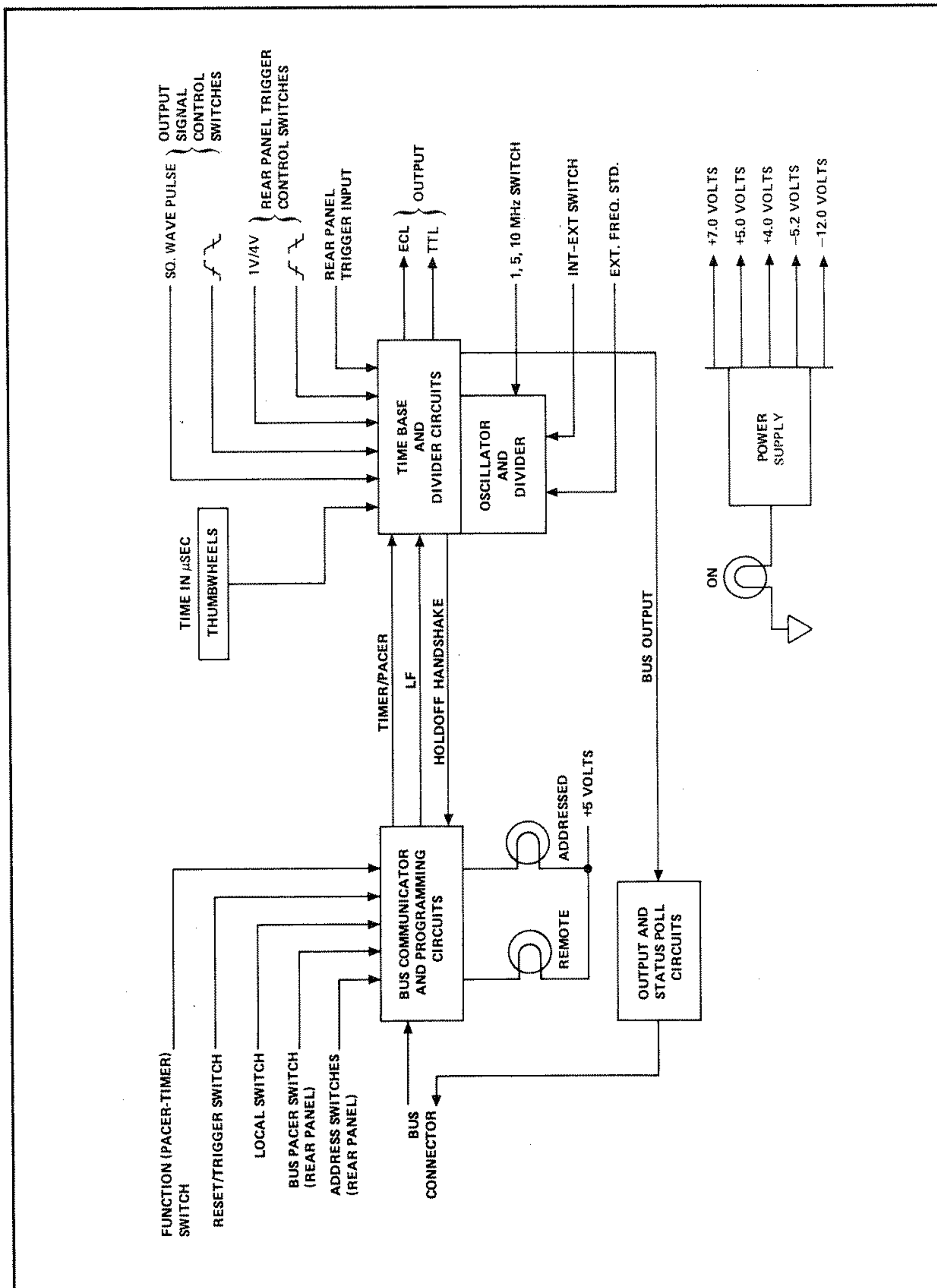


Figure 4-14. Bus Pacer Operation Block Diagram

4-41. DETAILED CIRCUIT DESCRIPTION

4-42. For a detailed circuit description refer to the schematic diagrams in Section VIII.

4-43. SIGNAL MNEMONICS

4-44. Table 4-1 is a list of signal mnemonics for the 59308A.

Table 4-1. Signal Mnemonics

Mnemonic	Name
IFC	Bus Clear
DAC	Data Accepted
DAV	Data Valid
DIO	Data Input/Output
DP	Decimal Point
GET	Group Execute Trigger
LF	Linefeed
LLO	Local Lockout
ATN	Multiple Response Enable
RFD	Ready for Data
SPE	Serial Poll Enable
SPD	Serial Poll Disable
SRQ	Service Request
SRQE	Service Request Enable

SECTION V
MAINTENANCE

5-1. INTRODUCTION

5-2. This section contains maintenance and service information including a table of recommended test equipment, in-cabinet performance check, adjustments, and troubleshooting.

5-3. TEST EQUIPMENT

5-4. Table 5-1 lists test equipment recommended for maintaining and checking the performance of the 59308A. Test equipment having equivalent characteristics may be substituted for the equipment listed.

Table 5-1. Recommended Test Equipment

Instrument	Required Characteristics	Recommended
Logic Probe	Test TTL signal levels	HP 1025T
Logic Pulser	Pulse in-circuit IC's	HP 10526T
Digital Voltmeter	0 to +175 volts Accuracy 0.3%	HP 3480A & HP 3482A
Oscilloscope	50 MHz bandwidth	HP 180A
Vertical Plug-in	50 mV/cm sensitivity	HP 1801A
Time Base Plug-in	50 MHz bandwidth	HP 1821A
Timer Counter	Measure 59308A output time intervals	HP 5327A
Test Oscillator	1, 5, 10 MHz frequency standard	HP 651A
Frequency Counter	Compatible with interface bus	HP 5345A Option 011
Pulse Generator	1 volt trigger (manual control)	HP 8012A

5-5. IN-CABINET PERFORMANCE CHECK

5-6. Table 5-2 contains procedures for checking the performance of the 59308A. The test setup is shown in Figure 5-1. The first part of the procedure checks the local (front-panel) operation of the 59308A using the internal time base with internal trigger, followed by procedures using external trigger. Then the local operation is checked using an external frequency standard as a time base and an external trigger. The last part of the procedure checks the remote (programmed) operation of the 59308A under the control of an interface bus controller. Included is a triggering test, serial polling test, accumulator output test, and a bus pacer mode test.

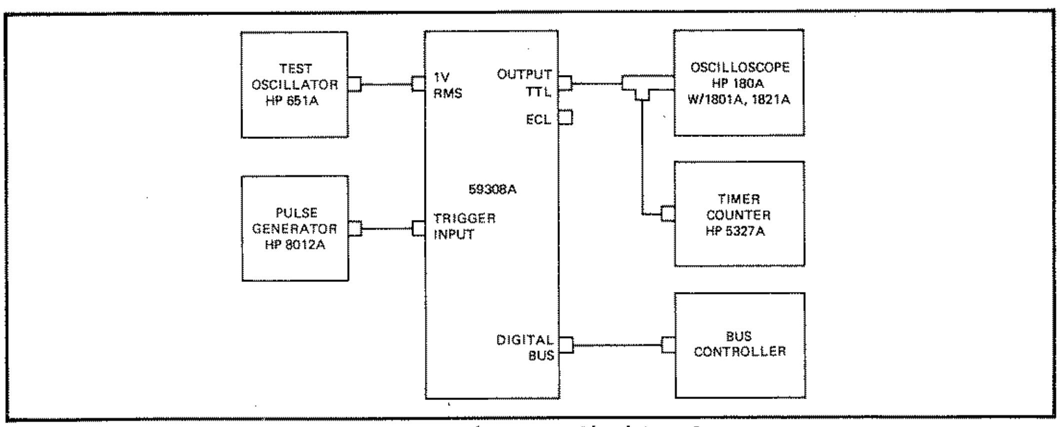


Figure 5-1. Performance Check Test Setup

Table 5-2. 59308A Performance Check

LOCAL OPERATION (INTERNAL TIME BASE — INTERNAL TRIGGER)

1. Ensure that the voltage selector switch in the power module on the rear panel of the 59308A is set to the line voltage to be used (115V or 230V). Install a 230 mA fuse for 115V or a 125 mA fuse for 230V operation.
2. Connect the equipment in the test setup shown in Figure 5-1. Do not apply power to any of the equipment at this point.
3. Apply power to the 59308A. The ON indicator should illuminate. Set rear-panel switches as follows:
   a. Set EXT INT switch to INT.
   b. Set BUS PACER switch to OFF.
   c. Set TRIGGER 1V–4V switch to 1V.
   d. Set SQ WAVE — 500n SEC PULSE switch to SQ WAVE.
4. Apply power to the oscilloscope and timer counter.
5. On the front panel of the 59308A:
   a. Set the TIME IN μSECONDS thumbwheel switches to 001E3.
   b. Set the FUNCTION switch to PACER.
   c. Press and release LOCAL button.
   d. Press and release TRIGGER/RESET button and observe 1 ms (50% duty cycle) square wave (≥ 2.5 volt) pulse train on oscilloscope. Check that period of output pulse is 1 ms on counter.
   e. Set the FUNCTION switch to TIMER.
   f. Press and release TRIGGER/RESET button and observe a 1 ms square wave (≥ 2.5 volt) pulse on oscilloscope.
6. On the rear panel of the 59308A:
   a. Set the SQ WAVE — 500n SEC PULSE switch to 500n SEC PULSE.
   b. Repeat steps 5b through 5f to check 500 ns pulse output.
   c. Disconnect cable from TTL OUTPUT and connect to ECL OUTPUT.
7. At the timer counter input, disconnect cable, connect 50-ohm termination and reconnect cable.
8. Repeat steps 6a and b, except observe pulses for ECL levels (0 to –2V).
9. Set the SQ WAVE — 500n SEC PULSE switch to SQ WAVE. Remove the 50-ohm termination at the timer counter input and reconnect cable. Disconnect cable from ECL OUTPUT on 59308A and connect to TTL OUTPUT.

LOCAL OPERATION (INTERNAL TIME BASE — EXTERNAL TRIGGER)

10. Apply power to the pulse generator and set the output for a 1V trigger pulse.
11. On the 59308A, set the FUNCTION switch to PACER.

Table 5-2. 59308A Performance Check (cont'd.)

12. On the pulse generator, press and release the MANUAL button and observe 1 ms (50% duty cycle) square wave (≥2.5 volt) pulse train.

13. Set the FUNCTION switch to TIMER. Press and release MANUAL button and observe a 1 ms square wave (≥2.5 volt) pulse on oscilloscope.

LOCAL OPERATION (EXTERNAL TIME BASE — EXTERNAL TRIGGER)

14. Apply power to the test oscillator and set to an output of 1 MHz at 1 volt.

15. On the rear panel of the 59308A, set the EXT INT switch to EXT and the EXT FREQ STD switch to 1 MHz.

16. Repeat steps 11 and 12.

REMOTE OPERATION

NOTE

In the following step, prior to sending the Trigger code (ASCII "R"), send the Disable Rear Panel Trigger code (ASCII "A").

17. Perform the preliminary procedures (paragraph 3-15) and the programming procedures (paragraph 3-17). To send the TIME IN μSECONDS code, select desired values from Table 3-2 and observe the oscilloscope and timer counter for proper square wave output.

TRIGGERING CHECK

18. Send timer code (ASCII "T"), followed by pacer code (ASCII "P").

19. On the pulse generator, press the MANUAL switch. (This action should not result in an output since the rear-panel disable code has been sent previously.)

20. Send the rear-panel enable code (ASCII "U") and press the MANUAL switch on the pulse generator. The 59308A output should be displayed on the oscilloscope.

21. Send timer code (ASCII "T"), rear-panel disable code (ASCII "A") and pacer code (ASCII "P").

NOTE

Universal commands (see Table 3-4) are sent by the controller only when the bus is in the Address Mode (ATN low).

22. Send the universal command Group Execute Trigger (ASCII 'BS"). The 59308A output should be displayed on the oscilloscope.

SERIAL POLLING TEST

23. Program the bus controller to send the Enable Service Request code (ASCII "S") and the universal command Serial Poll Enable (ASCII "CAN"). Send the talk address to the 59308A (the talk address must correspond to the listen address as shown in Table 3-1).

NOTE

Ensure that the 59308A is outputting at this point, otherwise the DIO7 line will not be set low in response to Serial Poll Enable.

Table 5-2. 59308A Performance Check (cont'd.)

24. Check to ensure that the 59308A has responded to Serial Poll Enable (sets DIO7 line low when ATN is high).

25. Send the universal commands Serial Poll Disable (ASCII "EM") and Untalk (ASCII underscore "_").

ACCUMULATOR OUTPUT TEST

26. Program the bus controller to send the talk address to the 59308A.

27. Check the talk output of the 59308A at the controller (refer to paragraph 3-25 for talk output format).

BUS PACER MODE TEST

28. To check the BUS PACER mode, disconnect the 59308A from the test setup and connect the DIGITAL OUTPUT via a 10631A, B, or C cable to an HP 5345A Option 011 Frequency Counter.

29. Apply power to the 59308A and set the BUS PACER switch to the ON position.

30. Apply power to the 5345A and set controls as follows:

    a. TALK ALWAYS — ADDRESSABLE switch to TALK ALWAYS.

    b. RANGE switch to CHK.

    c. SAMPLE RATE control to maximum counterclockwise.

    d. RESOLUTION Hz to 1M.

31. On the 59308A, set the TIME IN μSECONDS thumbwheel switches to 001E6. Check the display of the 5345A to ensure that the GATE indicator illuminates at 1 second intervals.

32. Vary the setting of the thumbwheel switches and ensure that the GATE display interval varies accordingly.

5-7. ADJUSTMENTS

5-8. The only adjustment required for the 59308A is the oscillator adjustment. Adjust the oscillator as follows:

a. Remove the top cover of the 59308A.

b. Connect the 1 MΩ INPUT connector of an HP 5345A Frequency Counter (or equivalent) to pin 2 of U2 in the 59308A.

c. Connect a suitable external frequency standard (such as an HP 5061A Cesium Beam) to the external oscillator input (10 MHz INPUT on the rear panel) of the 5345A. Set the external Frequency Standard to 10 MHz.

d. Apply power to the equipment and allow one hour warmup.

e. At the rear panel (OSC ADJ) of the 59308A, use an insulated tuning tool to adjust the oscillator for a display of 10 MHz on the 5345A.

5-9. TROUBLESHOOTING

5-10. To troubleshoot the 59308A, perform the in-cabinet performance test in Table 5-2 to determine the failure symptom. Refer to the overall functional description in Section IV to isolate the trouble to a major circuit area. Refer to the detailed circuit description on the schematic diagrams in Section VIII to isolate the trouble within a major circuit area.

PERFORMANCE CHECK TEST CARD

HEWLETT-PACKARD MODEL 59308A
TIMING GENERATOR

Test Performed by ____________

Date ____________

Instrument Serial No. ____________

TESTS	RESULTS
1. Local operation (Internal time base-internal trigger) operates per steps 1 thru 9, Table 5-2.	____________
2. Local operation (Internal time-base external trigger) operates per steps 10 thru 16, Table 5-2.	____________
3. Remote operation operates per step 17, Table 5-2.	____________
4. Triggering check operates per steps 18 thru 22, Table 5-2.	____________
5. Serial polling test operates per steps 23 thru 25, Table 5-2.	____________
6. Accumulator output test operates per steps 26 and 27, Table 5-2.	____________
7. Bus pacer mode test operates per steps 28 thru 32, Table 5-2.	____________

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replaceable parts for the 59308A. Table 6-1 lists replaceable parts. Table 6-2 lists the cabinet parts. Figure 6-1 identifies the cabinet parts. Table 6-3 contains a list of manufacturers and their respective codes.

6-3. Parts are listed in alpha-numerical order of their reference designator starting with A1 and ending with chassis and miscellaneous parts. The replaceable parts table includes the following information:

a. Reference designator (when applicable).

b. HP part number.

c. Total quantity (QTY) used in the instrument.

d. Description of the part (see abbreviations below).

6-4. ORDERING INFORMATION

6-5. To obtain replacement parts, address order of inquiry to your local Hewlett-Packard Sales and Service Office. Identify parts by their Hewlett-Packard part number.

6-6. To obtain a part that is not listed, include:

a. Instrument model number.
b. Instrument serial number.
c. Description of the part.
d. Function and location of the part.

REFERENCE DESIGNATIONS

A	= assembly
AT	= attenuator; isolator; termination
B	= fan; motor
BT	= battery
C	= capacitor
CP	= coupler
CR	= diode; diode thyristor; varactor
DC	= directional coupler
DL	= delay line
DS	= annunciator; signaling device (audible or visual); lamp; LED
E	= miscellaneous electrical part
F	= fuse
FL	= filter
H	= hardware
HY	= circulator
J	= electrical connector (stationary portion); jack
K	= relay
L	= coil; inductor
M	= meter
MP	= miscellaneous mechanical part
P	= electrical connector (movable portion); plug
Q	= transistor; SCR; triode thyristor
R	= resistor
RT	= thermistor
S	= switch
T	= transformer
TB	= terminal board
TC	= thermocouple
TP	= test point
U	= integrated circuit; microcircuit
V	= electron tube
VR	= voltage regulator; breakdown diode
W	= cable; transmission path; wire
X	= socket
Y	= crystal unit–piezo-electric
Z	= tuned cavity; tuned circuit

ABBREVIATIONS

A	= ampere
ac	= alternating current
ACCESS	= accessory
ADJ	= adjustment
A/D	= analog-to-digital
AF	= audio frequency
AFC	= automatic frequency control
AGC	= automatic gain control
AL	= aluminum
ALC	= automatic level control
AM	= amplitude modulation
AMPL	= amplifier
APC	= automatic phase control
ASSY	= assembly
AUX	= auxiliary
avg	= average
AWG	= American wire gauge
BAL	= balance
BCD	= binary coded decimal
BD	= board
BE CU	= beryllium copper
BFO	= beat frequency oscillator
BH	= binder head
BKDN	= breakdown
BP	= bandpass
BPF	= bandpass filter
BRS	= brass
BWO	= backward-wave oscillator
CAL	= calibrate
ccw	= counterclockwise
CER	= ceramic
CHAN	= channel
cm	= centimeter
CMO	= cabinet mount only
COAX	= coaxial
COEF	= coefficient
COM	= common
COMP	= composition
COMPL	= complete
CONN	= connector
CP	= cadmium plate
CRT	= cathode-ray tube
CTL	= complementary transistor logic
CW	= continuous wave
cw	= clockwise
cm	= centimeter
D/A	= digital-to-analog
dB	= decibel
dBm	= decibel referred to 1 mW
dc	= direct current
deg	= degree (temperature interval or difference)
°	= degree (plane angle)
°C	= degree Celsius (centigrade)
°F	= degree Fahrenheit
K	= degree Kelvin
DEPC	= deposited carbon
DET	= detector
diam	= diameter
DIA	= diameter (used in parts list)
DIFF AMPL	= differential amplifier
div	= division
DPDT	= double-pole, double-throw
DR	= drive

ABBREVIATIONS

DSB	= double sideband
DTL	= diode transistor logic
DVM	= digital voltmeter
ECL	= emitter coupled logic
EMF	= electromotive force
EDP	= electronic data processing
ELECT	= electrolytic
ENCAP	= encapsulated
EXT	= external
F	= farad
FET	= field-effect transistor
F/F	= flip-flop
FH	= flat head
FIL H	= fillister head
FM	= frequency modulation
FP	= front panel
FREQ	= frequency
FXD	= fixed
g	= gram
GE	= germanium
GHz	= gigahertz
GL	= glass
GND	= ground(ed)
H	= henry
h	= hour
HET	= heterodyne
HEX	= hexagonal
HD	= head
HDW	= hardware
HF	= high frequency
HG	= mercury
HI	= high
HP	= Hewlett-Packard
HPF	= high pass filter
HR	= hour (used in parts list)
HV	= high voltage
Hz	= Hertz
IC	= integrated circuit
ID	= inside diameter
IF	= intermediate frequency
IMPG	= impregnated
in	= inch
INCD	= incandescent
INCL	= include(s)
INP	= input
INS	= insulation
INT	= internal
kg	= kilogram
kHz	= kilohertz
kΩ	= kilohm
kV	= kilovolt
lb	= pound
LC	= inductance-capacitance
LED	= light-emitting diode
LF	= low frequency
LG	= long
LH	= left hand
LIM	= limit
LIN	= linear taper (used in parts list)
lin	= linear
LK WASH	= lock washer
LO	= low; local oscillator
LOG	= logarithmic taper (used in parts list)
log	= logarithm(ic)
LPF	= low pass filter
LV	= low voltage
m	= meter (distance)
mA	= milliampere
MAX	= maximum
MΩ	= megohm
MEG	= meg (10^6) (used in parts list)
MET FLM	= metal film
MET OX	= metal oxide
MF	= medium frequency; microfarad (used in parts list)
MFR	= manufacturer
mg	= milligram
MHz	= megahertz
mH	= millihenry
mho	= mho
MIN	= minimum
min	= minute (time)
...′	= minute (plane angle)
MINAT	= miniature
mm	= millimeter
MOD	= modulator
MOM	= momentary
MOS	= metal-oxide semiconductor
ms	= millisecond
MTG	= mounting
MTR	= meter (indicating device)
mV	= millivolt
mVac	= millivolt, ac
mVdc	= millivolt, dc
mVpk	= millivolt, peak
mV p-p	= millivolt, peak-to-peak
mVrms	= millivolt, rms
mW	= milliwatt
MUX	= multiplex
MY	= mylar
μA	= microampere
μF	= microfarad
μH	= microhenry
μmho	= micromho
μs	= microsecond
μV	= microvolt
μVac	= microvolt, ac
μVdc	= microvolt, dc
μVpk	= microvolt, peak
μVp-p	= microvolt, peak-to-peak
μVrms	= microvolt, rms
μW	= microwatt
nA	= nanoampere
NC	= no connection
N/C	= normally closed
NE	= neon
NEG	= negative
nF	= nanofarad
NI PL	= nickel plate
N/O	= normally open
NOM	= nominal
NORM	= normal
NPN	= negative-positive-negative
NPO	= negative-positive zero (zero temperature coefficient)
NRFR	= not recommended for field replacement
NSR	= not separately replaceable
ns	= nanosecond
nW	= nanowatt
OBD	= order by description
OD	= outside diameter
OH	= oval head
OP AMPL	= operational amplifier
OPT	= option
OSC	= oscillator
OX	= oxide
oz	= ounce
Ω	= ohm
P	= peak (used in parts list)
PAM	= pulse-amplitude modulation
PC	= printed circuit
PCM	= pulse-code modulation; pulse-count modulation
PDM	= pulse-duration modulation
pF	= picofarad
PH BRZ	= phosphor bronze
PHL	= Phillips
PIN	= positive-instrinsic-negative
PIV	= peak inverse voltage
pk	= peak
PL	= phase lock
PLO	= phase lock oscillator
PM	= phase modulation
PNP	= positive-negative-positive
P/O	= part of
POLY	= polystyrene
PORC	= porcelain
POS	= positive; position(s) (used in parts list)
POSN	= position
POT	= potentiometer
p-p	= peak-to-peak
PP	= peak-to-peak (used in parts list)
PPM	= pulse-position modulation
PREAMPL	= preamplifier
PRF	= pulse-repetition frequency
PRR	= pulse repetition rate
ps	= picosecond
PT	= point
PTM	= pulse-time modulation
PWM	= pulse-width modulation
PWV	= peak working voltage
RC	= resistance capacitance
RECT	= rectifier
REF	= reference
REG	= regulated
REPL	= replaceable
RF	= radio frequency
RFI	= radio frequency interference
RH	= round head; right hand
RLC	= resistance-inductance-capacitance
RMO	= rack mount only
rms	= root-mean-square
RND	= round
ROM	= read-only memory
R&P	= rack and panel
RWV	= reverse working voltage
S	= scattering parameter
s	= second (time)
...″	= second (plane angle)
S-B	= slow-blow (fuse) (used in parts list)
SCR	= silicon controlled rectifier; screw
SE	= selenium
SECT	= sections
SEMICON	= semiconductor
SHF	= superhigh frequency
SI	= silicon
SIL	= silver
SL	= slide
SNR	= signal-to-noise ratio
SPDT	= single-pole, double-throw
SPG	= spring
SR	= split ring
SPST	= single-pole, single-throw
SSB	= single sideband
SST	= stainless steel
STL	= steel
SQ	= square
SWR	= standing-wave ratio
SYNC	= synchronize
T	= timed (slow-blow fuse)
TA	= tantalum
TC	= temperature compensating
TD	= time delay
TERM	= terminal
TFT	= thin-film transistor
TGL	= toggle
THD	= thread
THRU	= through
TI	= titanium
TOL	= tolerance
TRIM	= trimmer
TSTR	= transistor
TTL	= transistor-transistor logic
TV	= television
TVI	= television interference
TWT	= traveling wave tube
U	= micro (10^{-6}) (used in parts list)
UF	= microfarad (used in parts list)
UHF	= ultrahigh frequency
UNREG	= unregulated
V	= volt
VA	= voltampere
Vac	= volts, ac
VAR	= variable
VCO	= voltage-controlled oscillator
Vdc	= volts, dc
VDCW	= volts, dc, working (used in parts list)
V(F)	= volts, filtered
VFO	= variable-frequency oscillator
VHF	= very-high frequency
Vpk	= volts, peak
Vp-p	= volts, peak-to-peak
Vrms	= volts, rms
VSWR	= voltage standing wave ratio
VTO	= voltage-tuned oscillator
VTVM	= vacuum-tube voltmeter
V(X)	= volts, switched
W	= watt
W/	= with
WIV	= working inverse voltage
WW	= wirewound
W/O	= without
YIG	= yttrium-iron-garnet
Zo	= characteristic impedance

NOTE

All abbreviations in the parts list will be in upper case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

Table 6-1. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	59308-60001	1	BOARD ASSY, MAIN (SERIES 1432)	28480	59308-60001
A1C1	0180-0106	1	CAPACITOR-FXD; 60UF+-20% 6VDC TA-SOLID	56289	150D606X000682
A1C2	0160-0158	3	CAPACITOR-FXD 5600PF +-10% 200WVDC POLYE	56289	292P56292
A1C3	0160-0158		CAPACITOR-FXD 5600PF +-10% 200WVDC POLYE	56289	292P56292
A1C4	0180-0218	1	CAPACITOR-FXD; .15UF+-10% 35VDC TA	56289	150D154X9035A2
A1C5	0160-3277	5	CAPACITOR-FXD .01UF +-20% 50WVDC CER	28480	0160-3277
A1C6	0121-0059	1	CAPACITOR; VAR; TRMR; CER; 2/8PF	73899	DV11PR8A
A1C7	0160-0196	1	CAPACITOR-FXD 24PF +-5% 300WVDC MICA 0+	28480	0160-0196
A1C8	0160-2198	1	CAPACITOR-FXD 20PF +-5% 300WVDC MICA 0+	28480	0160-2198
A1C9	0160-0205	1	CAPACITOR-FXD 10PF +-5% 500WVDC MICA 0+	28480	0160-0205
A1C10	0160-0297	1	CAPACITOR-FXD 1200PF +-10% 200WVDC POLYE	56289	292P12292
A1C11	0160-0159	1	CAPACITOR-FXD 6800PF +-10% 200WVDC POLYE	56289	292P68292
A1C12	0160-0207	1	CAPACITOR-FXD .01UF+-5% 200WVDC POLYE	56289	292P10325PTS
A1C13	0180-1743	1	CAPACITOR-FXD; .1UF+-10% 35VDC TA-SOLID	56289	150D104X9035A2
A1C14	0180-2101	1	CAPACITOR-FXD; 4000UF+75-10% 15VDC AL	56289	39D408G015JL4
A1C15	0180-1943	1	CAPACITOR-FXD; 1000UF+75-10% 25VDC AL	56289	39D108G025GL4
A1C16	0180-0230	2	CAPACITOR-FXD; 1UF+-20% 50VDC TA-SOLID	56289	150D105X0050A2
A1C17	0180-0230		CAPACITOR-FXD; 1UF+-20% 50VDC TA-SOLID	56289	150D105X0050A2
A1C18	0170-0082	1	CAPACITOR-FXD .01UF +-20% 50WVDC POLYE	84411	601PE1030R5W1
A1C19	0160-3277		CAPACITOR-FXD .01UF +-20% 50WVDC CER	28480	0160-3277
A1C20	0160-3277		CAPACITOR-FXD .01UF +-20% 50WVDC CER	28480	0160-3277
A1C21	0160-3277		CAPACITOR-FXD .01UF +-20% 50WVDC CER	28480	0160-3277
A1C22	0160-3277		CAPACITOR-FXD .01UF +-20% 50WVDC CER	28480	0160-3277
A1CR1	1901-0028	2	DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A1CR2	1901-0028		DIODE-PWR RECT 400V 750MA	04713	SR1358-9
A1CR3	1901-0535	5	DIODE-HOT CARRIER	28480	1901-0535
A1CR4	1901-0535		DIODE-HOT CARRIER	28480	1901-0535
A1CR5	1901-0040	24	DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR6	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR7	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR8	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR9	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR10	1901-0535		DIODE-HOT CARRIER	28480	1901-0535
A1CR11	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR12	1901-0535		DIODE-HOT CARRIER	28480	1901-0535
A1CR13	1901-0535		DIODE-HOT CARRIER	28480	1901-0535
A1CR14	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR15	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A1CR16	1906-0027	1	DIODE-MULT FULL WAVE BRIDGE RECTIFIER	04713	MDA922-6
A1CR17	1902-3024	1	DIODE-ZNR 2.87V 5% DO-7 PD=.4W TC=-.07%	04713	SZ 10939-26
A1CR18	1902-3070	1	DIODE-ZNR 4.22V 5% DO-7 PD=.4W TC=	04713	SZ 10939-74
A1Q1	1854-0071	7	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q5	1854-0009	1	TRANSISTOR NPN 2N709 SI TO-18 PD=300MW	28480	1854-0009
A1Q6	1850-0158	1	TRANSISTOR PNP 2N2635 GE CHIP	04713	2N2635
A1Q7	1853-0034	1	TRANSISTOR PNP SI CHIP TO-18 PD=360MW	28480	1853-0034
A1Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q9	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q10	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1R1	1810-0136	2	NETWORK-RES 10-PIN SIP .1-PIN-SPCG	28480	1810-0136
A1R2	1810-0136		NETWORK-RES 10-PIN SIP .1-PIN-SPCG	28480	1810-0136
A1R3	0683-2725	3	RESISTOR 2.7K 5% .25W CC TUBULAR	01121	CB2725
A1R4	0683-2725		RESISTOR 2.7K 5% .25W CC TUBULAR	01121	CB2725
A1R5	0683-2725		RESISTOR 2.7K 5% .25W CC TUBULAR	01121	CB2725
A1R6	0683-2725		RESISTOR 2.7K 5% .25W CC TUBULAR	01121	CB2725
A1R7	1810-0041	2	NETWORK-RES SIP .15-PIN-SPCG	28480	1810-0041
A1R9	0683-1035	1	RESISTOR 10K 5% .25W CC TUBULAR	01121	CB1035
A1R10	0683-1215	6	RESISTOR 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A1R11	N/A				
A1R12	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R13	0683-8225	1	RESISTOR 8.2K 5% .25W CC TUBULAR	01121	CB8225
A1R14	0683-1215		RESISTOR 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A1R15	0683-4725	13	RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R16	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R17	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R18	0683-1215		RESISTOR 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A1R19	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R20	0683-1025	6	RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R21	0698-3447	1	RESISTOR 422 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-422R-F
A1R22	0698-0084	1	RESISTOR 2.15K 1% .125W F TUBULAR	16299	C4-1/8-T0-2151-F
A1R23	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R24	0698-4037	1	RESISTOR 46.4 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-46R4-F

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Cont'd.)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R25	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R26	0683-2025	1	RESISTOR 2K 5% .25W CC TUBULAR	01121	CB2025
A1R27	0683-1225	1	RESISTOR 1.2K 5% .25W CC TUBULAR	01121	CB1225
A1R28	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R29	0683-3015	3	RESISTOR 300 OHM 5% .25W CC TUBULAR	01121	CB3015
A1R30	0683-3925	1	RESISTOR 3.9K 5% .25W CC TUBULAR	01121	CB3925
A1R31	0757-0463	1	RESISTOR 82.5K 1% .125W F TUBULAR	24546	C4-1/8-T0-8252-F
A1R32	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R33	0683-3015		RESISTOR 300 OHM 5% .25W CC TUBULAR	01121	CB3015
A1R34	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R35	1810-0055	2	NETWORK-RES 9-PIN SIP .15-PIN-SPCG	28480	1810-0055
A1R36	1810-0055		NETWORK-RES 9-PIN SIP .15-PIN-SPCG	28480	1810-0055
A1R37	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R38	0757-0460	1	RESISTOR 61.9K 1% .125W F TUBULAR	24546	C4-1/8-T0-6192-F
A1R39	0683-2215	2	RESISTOR 220 OHM 5% .25W CC TUBULAR	01121	CB2215
A1R40	0683-2215		RESISTOR 220 OHM 5% .25W CC TUBULAR	01121	CB2215
A1R41	0757-0398	1	RESISTOR 75 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-75R0-F
A1R42	0757-0416	1	RESISTOR 511 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-511R-F
A1R43	0757-0421	1	RESISTOR 825 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-825R-F
A1R44	0683-1025		RESISTOR 1K 5% .25W CC TUBULAR	01121	CB1025
A1R45	0698-0082	2	RESISTOR 464 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-4640-F
A1R46	0757-0419	1	RESISTOR 681 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-681R-F
A1R47	0686-1315	1	RESISTOR 130 OHM 5% .5W CC TUBULAR	01121	EB1315
A1R48	0698-0082		RESISTOR 464 OHM 1% .125W F TUBULAR	16299	C4-1/8-T0-4640-F
A1R49	0757-0442	2	RESISTOR 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A1R50	0683-1215		RESISTOR 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A1R51	1810-0041		NETWORK-RES SIP .15-PIN-SPCG	28480	1810-0041
A1R52	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R53	0683-1215		RESISTOR 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A1R54	0683-1215		RESISTOR 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A1R55	0757-0417	1	RESISTOR 562 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-562R-F
A1R56	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R57	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R58	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R59	N/A				
A1R60	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R61	0683-1015	1	RESISTOR 100 OHM 5% .25W CC TUBULAR	01121	CB1015
A1R62	0683-3015		RESISTOR 300 OHM 5% .25W CC TUBULAR	01121	CB3015
A1R63	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R64	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1R65	0683-4725		RESISTOR 4.7K 5% .25W CC TUBULAR	01121	CB4725
A1S1	3101-1826	1	SWITCH ASSY:ROCKER D.I.P. (7) SPST	00779	435166-1
A1U1	1820-0142	1	IC DGTL MC 1004P GATE	04713	MC1004P
A1U2	1820-1015	1	IC TTL S QUAD 2-INPUT MULTIPLEXER	75231	74S158N
A1U3	1820-0055	1	IC DGTL SN74 90 N COUNTER	01295	SN7490N
A1U4	1820-0584	3	IC DGTL DM74L 02N GATE	27014	DM74L02N
A1U5	1820-0596	3	IC DGTL DM74L 74N FLIP-FLOP	27014	DM74L74N
A1U6	1820-0174	1	IC DGTL SN74 04 N INVERTER	01295	SN7404N
A1U7	1820-0094	4	IC DGTL SN158 46N GATE	04713	MC846P
A1U8	1820-0094		IC DGTL SN158 46N GATE	04713	MC846P
A1U9	1820-1056	3	IC DGTL SN74 132 N COUNTER	01295	SN74132N
A1U10	1820-0621	4	IC DGTL SN74 38 N BUFFER	01295	SN7438N
A1U11	1820-0634	1	IC DGTL COUNTER	28480	1820-0634
A1U12	1820-0587	3	IC DGTL DM74L 10N GATE	27014	DM74L10N
A1U13	1820-1056		IC DGTL SN74 132 N COUNTER	01295	SN74132N
A1U14	1820-0621		IC DGTL SN74 38 N BUFFER	01295	SN7438N
A1U15	1816-0351	1	IC;DGTL;MEMORY	28480	1816-0351
A1U16	1820-0586	4	IC DGTL DM74L 04N INVERTER	27014	DM74L04N
A1U17	1820-0600	1	IC DGTL DM85L 90N COUNTER	27014	DM74L90N
A1U18	1820-0094		IC DGTL SN158 46N GATE	04713	MC846P
A1U19	1820-1047	2	IC DGTL SN74L 42AN DECODER	27014	DM74L42AN
A1U20	1820-1047		IC DGTL SN74L 42AN DECODER	27014	DM74L42AN
A1U21	1820-0596		IC DGTL DM74L 74N FLIP-FLOP	27014	DM74L74N
A1U22	1820-0621		IC DGTL SN74 38 N BUFFER	01295	SN7438N
A1U23	1820-0710	1	IC DGTL MULTIPLEXER	07263	93L22DC
A1U24	1820-1176	2	IC DGTL MC14015CP REGISTER	04713	MC14015OP
A1U25	1820-1176		IC DGTL MC14015CP REGISTER	04713	MC14015OP
A1U26	1820-0904	1	IC DGTL COMPARATOR	07263	93L24DC
A1U27	1816-0350	1	IC;DGTL;MEMORY	28480	1816-0350
A1U28	1820-0586		IC DGTL DM74L 04N INVERTER	27014	DM74L04N
A1U29	1820-0584		IC DGTL DM74L 02N GATE	27014	DM74L02N
A1U30	1820-0586		IC DGTL DM74L 04N INVERTER	27014	DM74L04N
A1U31	1820-0583	3	IC DGTL DM74L 00N GATE	27014	DM74L00N
A1U32	1820-0595	1	IC DGTL DM74L 73N FLIP-FLOP	27014	DM74L73N
A1U33	1820-0583		IC DGTL DM74L 00N GATE	27014	DM74L00N
A1U34	1820-0587		IC DGTL DM74L 10N GATE	27014	DM74L10N
A1U35	1820-0621		IC DGTL SN74 38 N BUFFER	01295	SN7438N

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Cont'd.)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1U36	1820-0585	4	IC DGTL DM74L 03N GATE	27014	DM74L03N
A1U37	1820-0585		IC DGTL DM74L 03N GATE	27014	DM74L03N
A1U38	1820-0585		IC DGTL DM74L 03N GATE	27014	DM74L03N
A1U39	1820-0585		IC DGTL DM74L 03N GATE	27014	DM74L03N
A1U40	1820-0586		IC DGTL DM74L 04N INVERTER	27014	DM74L04N
A1U41	1820-0583		IC DGTL DM74L 00N GATE	27014	DM74L00N
A1U42	1820-1056		IC DGTL SN74 132 N COUNTER	01295	SN74132N
A1U43	1820-1181	3	IC DGTL MC14522AL COUNTER	04713	MC14522AL
A1U44	1820-1181		IC DGTL MC14522AL COUNTER	04713	MC14522AL
A1U45	1820-1181		IC DGTL MC14522AL COUNTER	04713	MC14522AL
A1U46	1820-1180	1	IC, DIGITAL	28480	1820-1180
A1U47	1820-0094		IC DGTL SN158 46N GATE	04713	MC846P
A1U48	1820-0584		IC DGTL DM74L 02N GATE	27014	DM74L02N
A1U49	1820-0587		IC DGTL DM74L 10N GATE	27014	DM74L10N
A1U50	1820-0596		IC DGTL DM74L 74N FLIP-FLOP	27014	DM74L74N
A1U51	1820-0282	1	IC DGTL SN74 86 N GATE	01295	SN7486N
A1U52	1820-0730	1	IC DGTL MULTIVIBRATOR	34335	96L02DC
A1U53	1826-0178	1	IC LIN LM320H-12 REGULATOR	27014	LM320H-12
A1U54	1826-0122	1	IC LIN REGULATOR	07263	7805UC
A1U55	1826-0179	1	IC LIN LM320H- 5.2 REGULATOR	27014	LM320H-5.2
A1Y1	0410-0405	1	CRYSTAL:QUARTZ 10 MHZ	28480	0410-0405
			A1 MISCELLANEOUS		
	0380-0342	6	STANDOFF-RVT-ON KNRL .125-LG 6-32-THD	28480	0380-0342
	1200-0423	4	SOCKET:IC BLK 16 CONTACT	23880	CSA2900-16B
	1200-0433	1	SOCKET; ELEC; IC 24-CONT	28480	1200-0433
	1200-0485	1	SOCKET:IC 14-PIN PC MOUNTING	28480	1200-0485
	1205-0011	2	HEAT-DISSIPATOR SGL TO-5 PKG	28480	1205-0011
A2	59308-60003	1	BOARD ASSY, THUMBWHEEL (SERIES 1432)	28480	59308-60003
A2CR1	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR2	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR3	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR4	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR5	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR6	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR7	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR8	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR9	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR10	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR11	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR12	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR13	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR14	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR15	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2CR16	1901-0040		DIODE-SWITCHING 2NS 30V 50MA	28480	1901-0040
A2P3	1251-0472	3	CONNECTOR; PC EDGE; 6-CONT; DIP SOLDER	71785	252-06-30-300
A2P4	1251-0472		CONNECTOR; PC EDGE; 6-CONT; DIP SOLDER	71785	252-06-30-300
A2S1	1251-2317	4	CONNECTOR:MULTI SWITCH	28480	1251-2317
A2S2	1251-2317		CONNECTOR:MULTI SWITCH	28480	1251-2317
A2S3	1251-2317		CONNECTOR:MULTI SWITCH	28480	1251-2317
A2S4	1251-2317		CONNECTOR:MULTI SWITCH	28480	1251-2317
A3	59308-60002	1	REAR PANEL ASSY (SERIES 1432)	28480	59308-60002
A3J1	1250-1163	2	CONNECTOR-RF BNC FEM SGL HOLE RR	28480	1250-1163
A3J2	1250-1163		CONNECTOR-RF BNC FEM SGL HOLE RR	28480	1250-1163
A3S1	3101-1596	6	SWITCH; SL; DPDT NS; 1A 125VAC	28480	3101-1596
A3S2	3101-1596		SWITCH; SL; DPDT NS; 1A 125VAC	28480	3101-1596
A3S3	3101-1598	1	SWITCH; SL; DP3T NS; 1A 125VAC	28480	3101-1598
A3S4	3101-1596		SWITCH; SL; DPDT NS; 1A 125VAC	28480	3101-1596
A3S5	3101-1596		SWITCH; SL; DPDT NS; 1A 125VAC	28480	3101-1596
A3S6	3101-1596		SWITCH; SL; DPDT NS; 1A 125VAC	28480	3101-1596
A3S7	3101-1596		SWITCH; SL; DPDT NS; 1A 125VAC	28480	3101-1596
A3W1	8120-1966	1	CABLE CA ASSY 24-COND	0121C	CA-024P02-261-AB-012.5
A4	59308-60004	1	BOARD ASSY, LAMP (SERIES 1432)	28480	59308-60004
	05100-2052	2	SPACER, CAPTIVE	28480	05100-2052
A4DS1	2140-0397	3	LAMP; INCAND; BULB T-1-3/4; 5V	JP012	OL-7828PS
A4DS2	2140-0397		LAMP; INCAND; BULB T-1-3/4; 5V	JP012	OL-7828PS
A4DS3	2140-0397		LAMP; INCAND; BULB T-1-3/4; 5V	JP012	OL-7828PS

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Cont'd.)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4P1	1251-0472		CONNECTOR; PC EDGE; 6-CONT; DIP SOLDER	71785	252-06-30-300
A4S1	3101-1261	2	SWITCH; PB 1-STA RECT SPDT	09353	P8121
A4S2	3101-1261		SWITCH; PB 1-STA RECT SPDT	09353	P8121
A4S3	3101-0574	1	SWITCH; SL; DPDT NS; 1A 120VAC	28480	3101-0574

See introduction to this section for ordering information

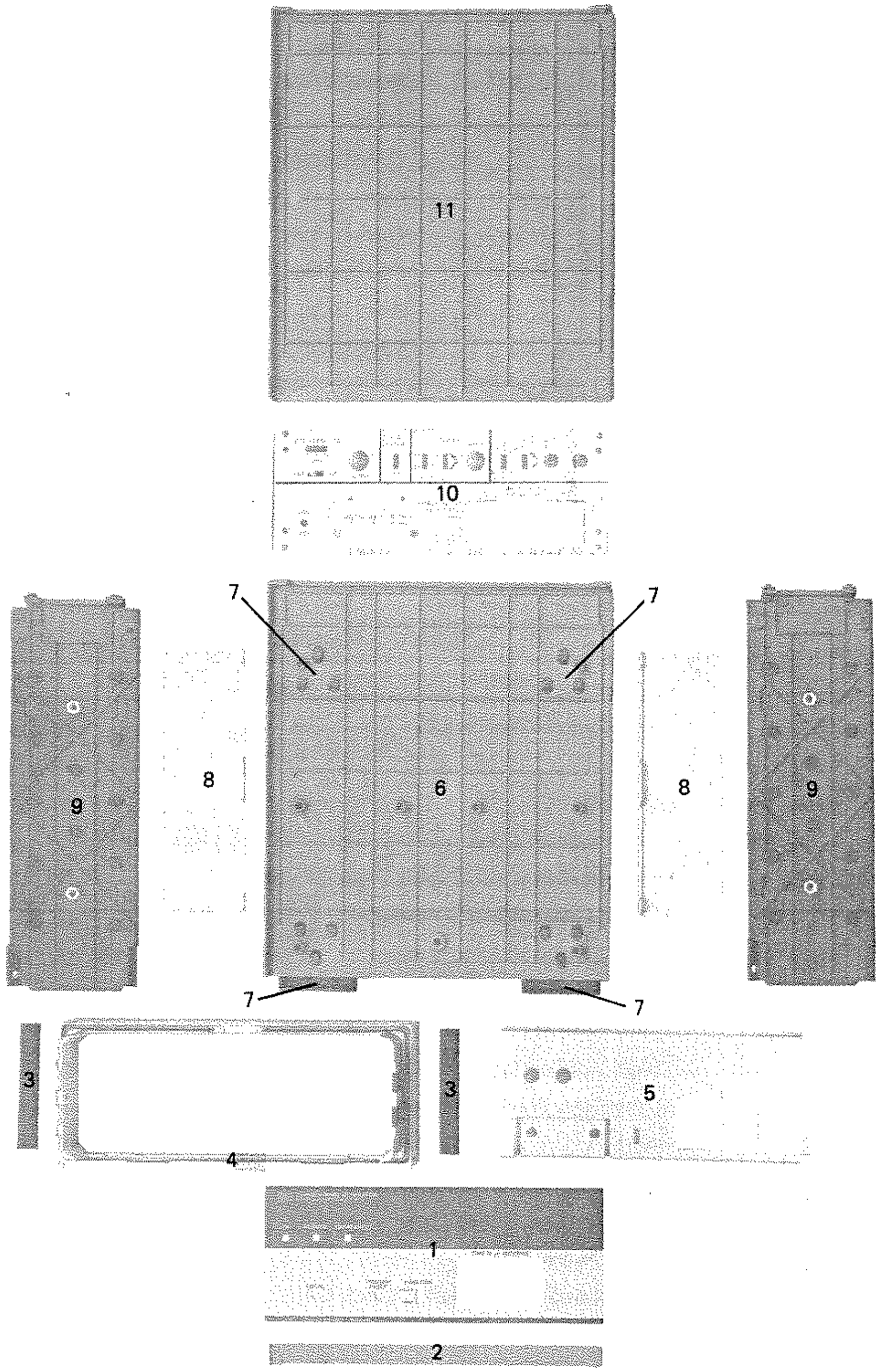


Figure 6-1. 59308A Cabinet Parts

Table 6-2. 59308A Cabinet Parts

	HP Part No.	Qty.	Description	Mfr. Code	Mfr. Part No.
1	59308-00003	1	Panel, Front	28480	59308-00003
2	5040-7203	1	Trim, Top	28480	5040-7203
3	5001-0438	2	Trim, Sides	28480	5001-0438
4	5020-8813	1	Frame, Front	28480	5020-8813
5	59308-00004	1	Subpanel, Front	28480	59308-00004
6	5040-7209	1	Cover, Bottom	28480	5040-7209
7	5040-7201	4	Foot	28480	5040-7201
8	59308-00002	2	Bracket, Side	28480	59308-00002
9	5040-7212	2	Cover, Side	28480	5040-7212
10	59308-00001	1	Panel, Rear	28480	59308-00001
11	5040-7208	1	Cover, Top	28480	5040-7208

Table 6-3. Manufacturers Code List

Mfr. No.	Manufacturer Name	Address	Zip Code
JP012	Oshino Electric Lamp Works	Tokyo, Japan	
00779	Amp, Inc.	Harrisburg, PA	17105
01121	Allen Bradley Co.	Milwaukee, WI	53212
01210	Circuit Assembly Corp.	Santa Ana, CA	92707
01295	Texas Instruments, Inc., Semiconductor Comp. Div.	Dallas, TX	75231
04713	Motorola Semiconductor Products	Phoenix, AZ	85008
07263	Fairchild Semiconductor Division	Mountain View, CA	94040
09353	C and K Components, Inc.	Watertown, MA	02172
16299	Corning Glass Works, Electronic Components Div.	Raleigh, NC	27604
23880	Stanford Applied Engineering, Inc.	Santa Clara, CA	95050
24546	Corning Glass Works (Bradford)	Bradford, PA	16701
27014	National Semiconductor Corp.	Santa Clara, CA	95051
28480	Hewlett-Packard Company, Corporate Headquarters	Palo Alto, CA	94304
34335	Advanced Micro Devices, Inc.	Sunnyvale, CA	94086
56289	Sprague Electric Co.	North Adams, MA	01247
71785	TRW Electronic Components, Cinch Div.	Elk Grove Village, IL	60007
73899	J.F.D. Electronics Corp.	Brooklyn, NY	11219
75231	The Kawneer Co.	Niles, MI	49120
84411	TRW Capacitor Div.	Ogallala, NE	69153

SECTION VII
OPTIONS AND MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section contains information necessary to adapt this manual to older instruments. As options are made available for this instrument, operating and installation instructions will be provided.

7-3. MANUAL CHANGES

7-4. This manual applies directly to Model 59308A having serial prefix 1508A (refer to paragraph 1-11).

7-5. Newer Instruments

7-6. As changes are made, newer instruments may have serial prefixes that are not listed in this manual. The manuals for these instruments are supplied with a manual change sheet, containing the required information. Contact the nearest Hewlett-Packard Sales and Service Office for information if this sheet is missing.

7-7. Older Instruments

7-8. To adapt this manual to instruments having serial prefix 1404A, make the corrections listed in the following paragraphs:

7-9. Change the schematic diagram Figure 8-3 as follows:

a. In the upper left side of Sheet 2 of the diagram delete integrated circuits U47B and U48A. Connect pin 6 of U49B to pins 1 and 2 of U47A and to pin 10 of U43, 44, 45, and 56 and to pin 13 of U47D and U6F.

b. In the upper right side of Sheet 2 of the diagram connect pin 9 of U47C to pin 10 of U50B and to pin 3 of U52A. Disconnect pin 9 of U47C from pin 12 of U6 (Sheet 3).

c. In the middle right side of Sheet 2 of the diagram, in parallel with inverter U40C, connect another inverter labeled U47B. Connect output pin 6 of U47B to pin 6 of U40C and connect input pins 4 and 5 of U47B to pin 5 of U40C.

d. In the lower right side of sheet 4 of the diagram, delete diode CR18 and the 4.2V output. Change diode CR17 breakdown voltage from 2.87V to 6.81V and connect the anode to common.

7-10. Change the parts list, Table 6-1, as follows:

a. Delete CR18 1902-3070 DIODE: ZENER 4.22VZ .4W MAX PD; 04713; SZ10939-74; QTY 1.

b. Delete CR17 1902-3024 DIODE: ZENER 2.87VZ .4W MAX PD; 04713; SZ10939-26; QTY 1.

c. Add CR17 1902-0048 DIODE: ZENER 6.81VZ .4W MAX PD; 15818; CD331573; QTY 1.

SECTION VIII
SCHEMATIC DIAGRAMS

8-1. INTRODUCTION

8-2. This section includes schematic diagram notes (Figure 8-1), digital bus connector pin designations, component location and schematic diagrams for the 59308A Timing Generator.

8-3. SCHEMATIC DIAGRAM NOTES, ASSEMBLY NUMBERS, AND REFERENCE DESIGNATORS

8-4. Figure 8-1 shows the symbols used on the schematic diagram. At the bottom of Figure 8-1, the system for reference designators, assemblies, and subassemblies are shown. On the schematic, a table of active elements is included which lists the HP part number for IC's, diodes and transistors.

8-5. Reference Designators

8-6. Assemblies such as printed circuit boards are assigned numbers in sequence, A1, A2, etc. As shown in Figure 8-1, subassemblies within an assembly are given a subroutine A number. For example, rectifier subassembly A1 has the complete designator of A25A1. For individual components, the complete designator is determined by adding the assembly number and subassembly number if any. For example, CR1 on the rectifier assembly is designated A25A1CR1. On the schematic, a table of reference designators is included which lists the number of designations assigned.

8-8. Identification Markings on Printed-Circuit Boards

8-9. HP printed circuit boards (see Figure 8-1) have four identification numbers; an assembly part number, a series number, a revision letter, and a production code.

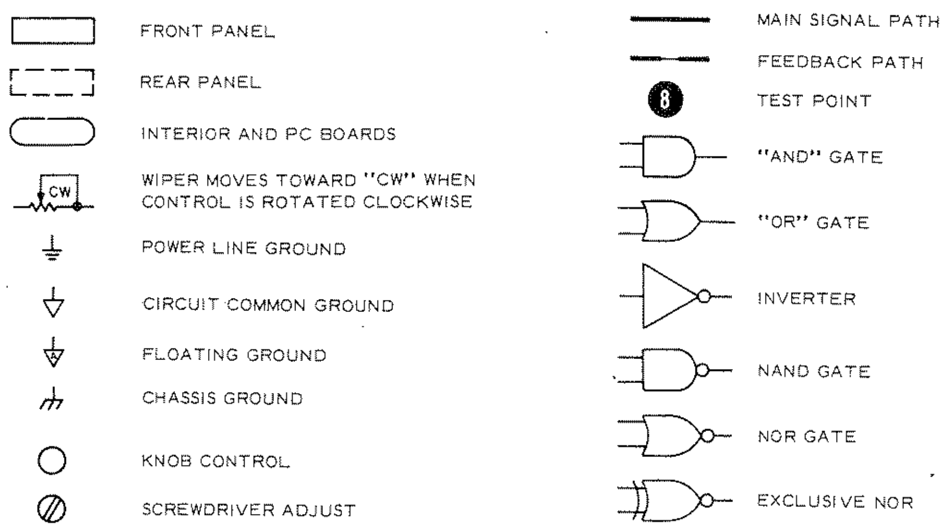
8-10. The assembly part number has 10 digits (such as 05340-60037) and is the primary identification. All assemblies with the same part number are interchangeable. When a production change is made on an assembly that makes it incompatible with previous assemblies, a change in part number is required. The series number (such as 1248A) is used to document minor electrical changes. As changes are made, the series number is incremented. When replacement boards are ordered, you may receive a replacement with a different series number. If there is a difference between the series number marked on the board and the schematic in this manual, a minor electrical difference exists. If the number on the printed-circuit board is lower than that on the schematic, refer to Section for backdating information. If it is higher, refer to the loose leaf manual change sheets for this manual. If the manual change sheets are missing, contact your local Hewlett-Packard Sales and Service Office listed on the back cover of this manual.

4-11. Revision letters (A, B, etc.) denote changes in printed circuit layout. For example, if a capacitor type is changed (electrical value may remain the same) and requires different spacing for its leads, the printed circuit board layout is changed and the revision letter is incremented to the next letter. When a revision letter changes, the series number is also usually changed. The production code is the four-digit, seven segment number used for production purposes.

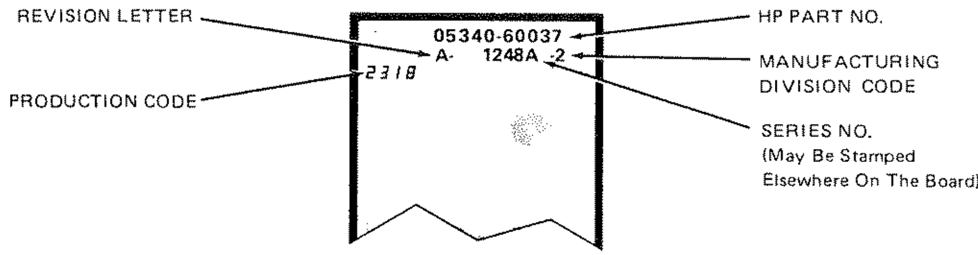
8-12. COMPONENT LOCATORS

8-13. Component locators for each printed circuit assembly are located next to the schematic diagram.

SYMBOLS



PRINTED CIRCUIT BOARD IDENTIFICATION



REFERENCE DESIGNATIONS

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION. JACKS ARE THE STATIONARY CONNECTORS AND PLUGS ARE THE MORE MOVEABLE OF TWO CONNECTORS.

ASSEMBLY	ABBREVIATION	COMPLETE DESCRIPTION
A25	C1	A25C1
A25A1	CR1	A25A1CR1
NO PREFIX	J3	J3

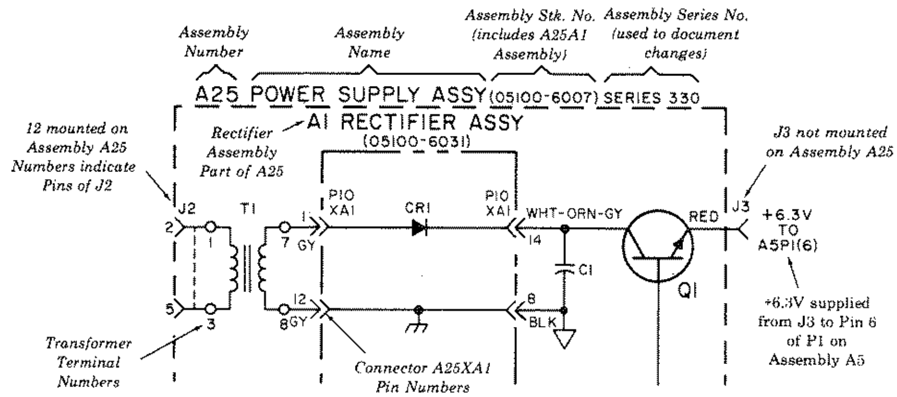
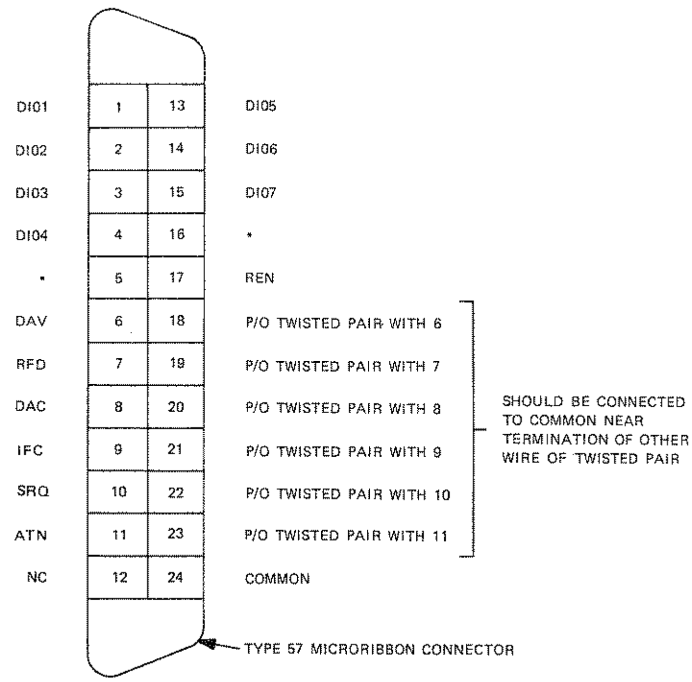


Figure 8-1. Schematic Diagram Notes



*THESE PINS ARE TERMINATED WITH RESISTIVE NETWORKS (SEE SCHEMATIC) AND NORMALLY FLOAT AT APPROXIMATELY 3V.

NOTE 1: PINS 18 THROUGH 23 SHOULD BE CONNECTED TO COMMON NEAR THE TERMINATION OF THE OTHER WIRE OF ITS TWISTED PAIR. PIN 12 IS CONNECTED TO COMMON ONLY AT THE CONTROLLER.

Pin #	Line Name	Use
1-4, 13-15	DIO1-7	Carries characters to 59308A for programming or for processing as Bus Commands.
16	DIO8	Not monitored or driven; terminated by resistive network.
6 7 8	DAV RFD DAC	These three lines make up the "handshake" system on the HP-IB. DAV is monitored and driven and RFD and DAC are driven by 59308A to control rate of data transferred on DIO lines.
9	IFC	Unconditionally clears Listen and Talk FF's halting remote operation.
11	ATN	Indicates to 59308A whether character on DIO lines is Bus command or for display.
17	REN	When low, places the 59308A in remote operation.
5	EOI	Not monitored or driven; terminated by resistive network.
10	SRQ	Indicates the 59308A wants the attention of the controller.
12	Shield	Not connected.
18-24	Grounds	Connected to chassis ground.

Figure 8-2. Digital Bus Connector Pin Designations

BUS COMMUNICATOR AND PROGRAMMING CARD (Figure 8-3, Sheet 1). The bus communicator and programming card contains circuits for communicating with the bus. It also contains circuits for processing software instructions for the remote programming mode of the 59308A.

INPUT DECODER ROM (U27). This ROM has two operating modes which are controlled by the state of the ATN signal. When ATN is low the ROM monitors the DIO lines and checks for valid talk addresses and valid Universal Commands. When ATN is high, the ROM checks for valid programming codes and data codes.

ADDRESS COMPARATOR (U26). The address comparator monitors DIO lines 1 through 5 and compares their logic state with the logic state of switches 1 through 5 on the rear-panel address switches of the 59308A. The address comparator outputs a high signal (on pin 14) to indicate comparison. This high signal on pin 14 combines with the valid talk address or valid listen address signal from Input Decoder ROM U27 to set the Talk and Listen FF's.

LISTEN FF (U32A). This FF is set when the valid Listen Address signal from U31B(6) and the address comparison signal from the Address Comparator are both present. When set, this FF indicates the 59308A has been addressed to listen. This FF is cleared by IFC or by the Unlisten Command and is clocked by DAV generated from the Handshake Generator, while ATN is low.

TALK FF (U32B). This FF is set by the valid Talk Address signal from Decoder ROM U27 in combination with the flag from Address Comparator U26. When set the FF indicates that the 59308A has been addressed to talk. The FF is cleared by IFC, by the Untalk command or by a Talk address that differs from the setting of the Address Switch.

GET DETECTOR (U49C and U29C). This circuit is controlled by the Listen Address signal from the Listen FF, DAV from the Handshake Generator and the universal command Group Execute Trigger (GET) from the DIO lines and the Input Decoder ROM (U27). When the 59308A has been addressed to listen and receives the Universal Command GET, the output of the GET detector, U49C(8), goes low, triggering the 59308A.

PROGRAM CODE DECODER (U20). The program code decoder monitors the outputs of the Input Decoder ROM and sets various clock signals in response to software programming codes processed by the Input Decoder ROM. The clock signals set are Data Clock, which is controlled by ASCII codes 0 through 9, Function Clock, which is controlled by ASCII codes P (pacer) and T (trigger); SRQ Enable Clock, which is controlled by ASCII codes S (enable) and D (disable); Trigger/Reset Clock, controlled by ASCII code U (enable) and A (disable).

UNIVERSAL COMMAND DECODER (U19). This decoder monitors the output of the Input Decoder ROM and sets four flags in response to certain Universal Commands on the DIO lines. When the universal command Local Lockout is on the DIO lines the local lockout output of the Universal Command Decoder will be set. In a similar manner, Serial Poll Enable and Serial Poll Enable and Remote Enable are set.

FUNCTION STORAGE FF (U21A), SERVICE REQUEST (SRQ) ENABLE STORAGE FF (U21B), and REAR-PANEL TRIGGER STORAGE FF (U50A). These storage FF's store the state of the signal on the DIO3 line for use in remote programming the 59308A.

LOCAL LOCKOUT (LLO) FF (U33). This FF is set by the universal command for Local Lockout (ASCII DC1) after the command has been processed by Input Decoder ROM U27 and Universal Command Decoder U19. When set, the LLO FF disables the LOCAL pushbutton on the front panel of the 59308A. The LLO FF is cleared by the Remote Disable command (REN high).

REMOTE FF (U34C and U35D). This FF is set by the Remote Enable signal from the Universal Command Decoder U19 and is cleared by the front-panel LOCAL pushbutton or by the Remote Disable command (REN high).

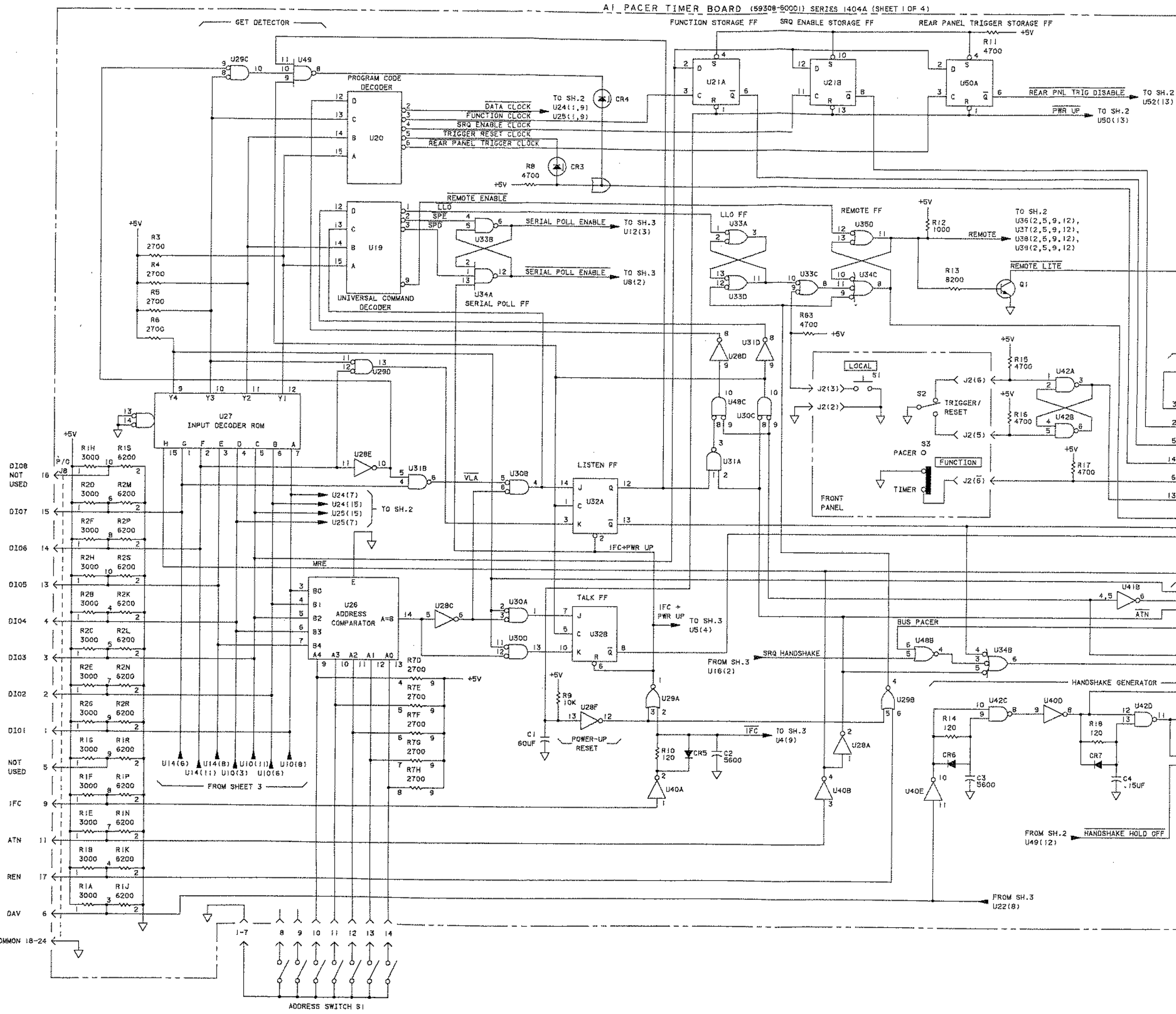
SERIAL POLL FF (U33B and U34A). This FF is set by the Serial Poll Enable signal from the Universal Command Decoder and is cleared by the Serial Poll Disable signal from the Universal Command Decoder.

FUNCTION CONTROL (U23). This circuit provides either remote programming control or front-panel control of the internal function lines, depending on the state of U23, pin 1. Pin 1 is controlled by the Remote signal. In remote operation, pin 1 is low and pins 2, 5, and 14 control the function signals. In local operation pin 1 is high and the front-panel controls (via pins 6 and 13) control the function signals.

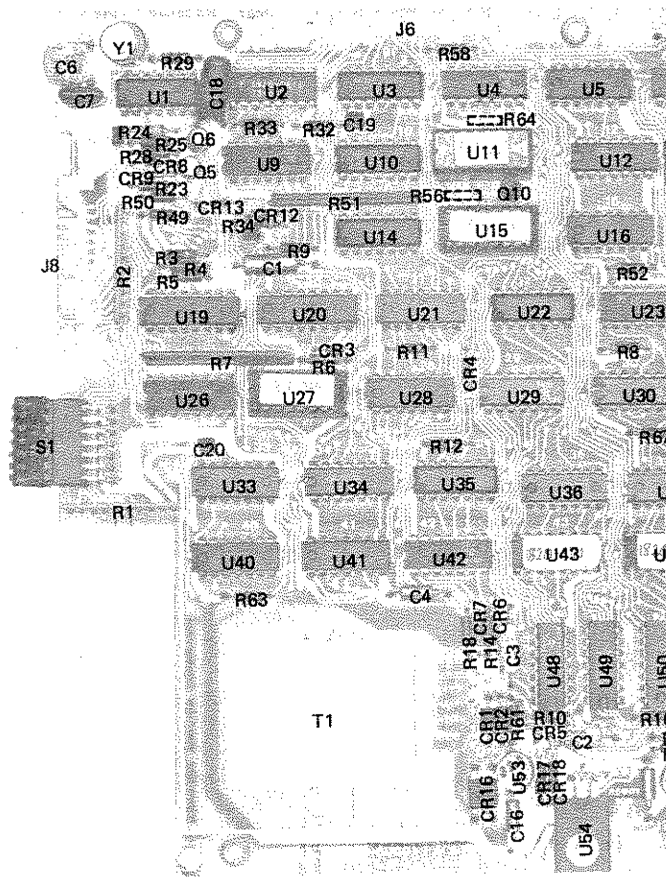
LINE FEED DETECTOR (U12C, U40F, and U41A). This detector is used in the bus pacer mode. The detector detects ASCII linefeed (LF) by monitoring the ATN line, the output of the Input Decoder ROM and the DAV line from the Handshake Generator. When the LF signal is present U41 pin 3 goes low.

HANDSHAKE GENERATOR (U35A, U35B, U40D, U40E, U41C, U41D, U42C and U42D). The Handshake Generator circuit responds to the Data Valid (DAV) signal from the Interface Bus and develops the Ready for Data (RFD) and Data Accepted (DAC) signals which are sent to the bus. The circuitry also produces a clock signal (DAV-500 ms) that clocks circuits U41B, U30C, and U48C.

A1 PACER TIMER BOARD (59308-60001) SERIES 1404A (SHEET 1 OF 4)



1



REFERENCE DESIGNATIONS

AI
- CI – C22
- CRI – CRI8
- QI – QIO
- RI – R65
- SI
- UI – U55
- YI

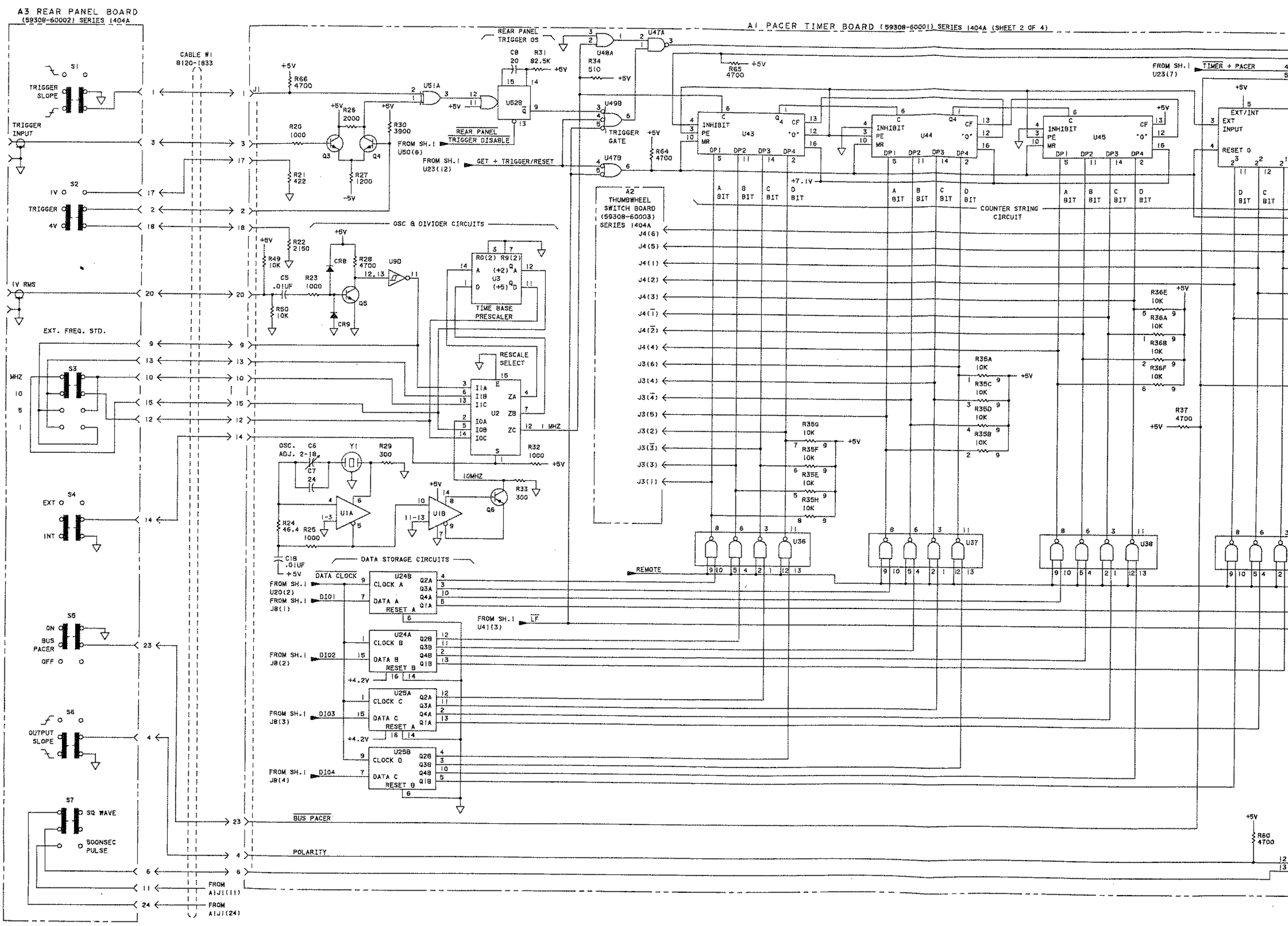
A3
- JI – J2
- SI – S7
- WI

A4
- DSI – DS3
- PI
- SI – S3

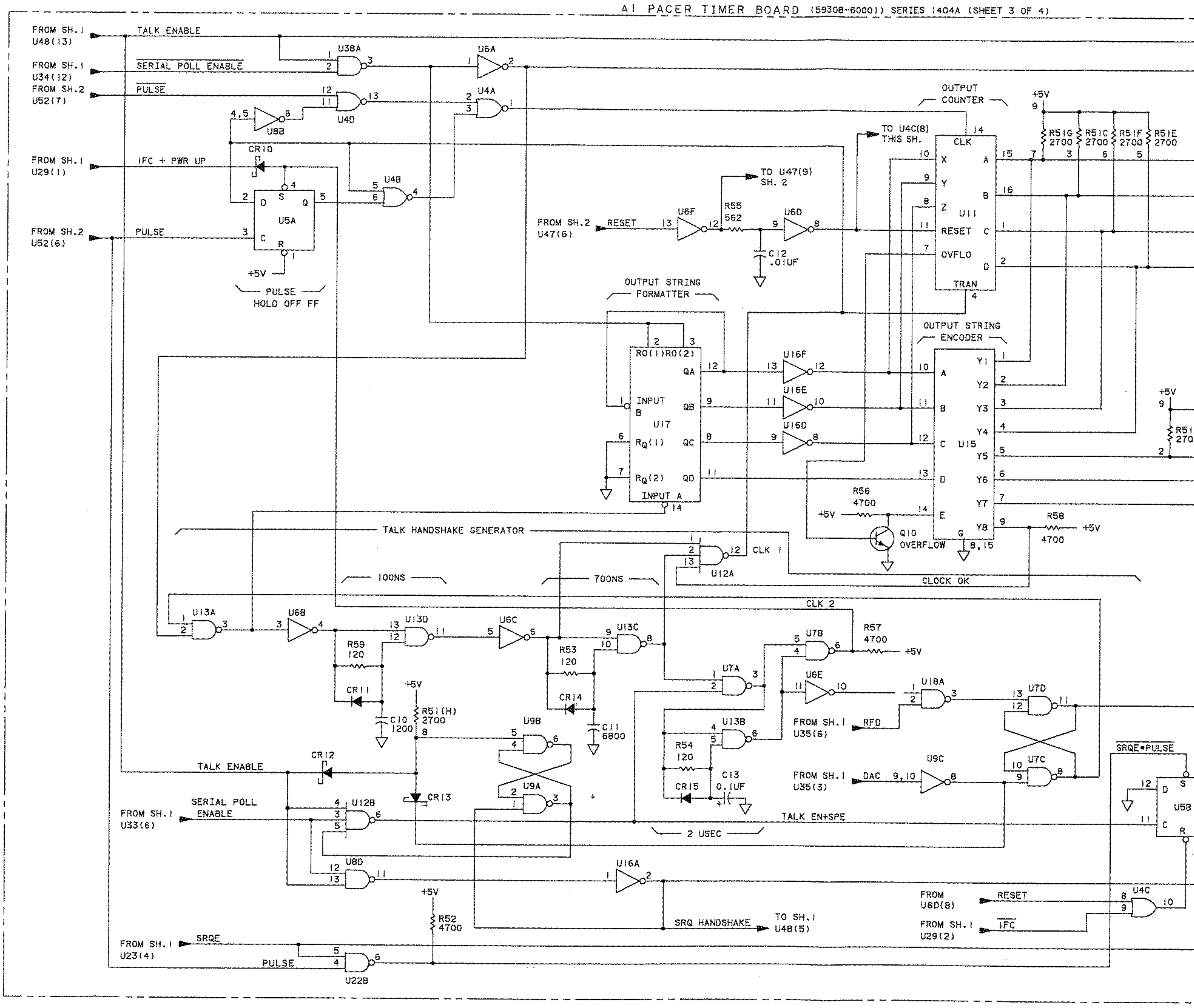
1.

2.

3.


A3 REAR PANEL BOARD
(59308-60002) SERIES 1404A
A1 PACER TIMER BOARD (59308-60001) SERIES 1404A (SHEET 2 OF 4)
CABLE W1
8120-1833
A2
THUMBWHEEL
SWITCH BOARD
(59308-60003)
SERIES 1404A
TRIGGER SLOPE
TRIGGER INPUT
1V RMS
EXT. FREQ. STD.
OSC & DIVIDER CIRCUITS
TIME BASE PRESCALER
RESCALE SELECT
DATA STORAGE CIRCUITS
COUNTER STRING CIRCUIT
REAR PANEL TRIGGER OS
REAR PANEL TRIGGER DISABLE
TRIGGER GATE
GET + TRIGGER/RESET
TIMER + PACER
BUS PACER
POLARITY
REMOTE
DATA CLOCK

AI PACER TIMER BOARD (59308-60001) SERIES 1404A (SHEET 3 OF 4)



OUTPUT AND STATUS POLL CIRCUITS (Figure 8-3, Sheet 3). These
the 59308A, as described in the following paragraphs:

TALK HANDSHAKE GENERATOR (U6B, C, and F, U7A, B, C, and D,
generator monitors the RFD and DAC lines and when it has been
output DAV to the bus and generate two clock signals to the outp
Counter and Clock 2 goes to the Output Holdoff FF.

OUTPUT COUNTER (U11). This counter accumulates the number
since the last trigger. The Output Counter outputs one digit for
(U10A, B, C, and D, and U14B, C, and D). The Output Counter can
output sequence.

OUTPUT STRING FORMATTER (U17). This circuit is clocked by the
the flow of information from the output circuits to the bus.

OUTPUT STRING ENCODER (U15). This encoder, in conjunction
proper ASCII character to the bus. The Output Counter suppl
information and the Output String Encoder supplies bits 5, 6, and 7
(SP), carriage return (CR), and linefeed (LF).

PULSE HOLDOFF FF (U5A). This FF stores the pulse from the Pulse
59308A is outputting on the bus. Once the output to the bus is com
to the Output Counter. This ensures that the Output Counter do

SERVICE REQUEST (SRQ) FF (U5B). This FF controls the SRQ line t
Request Enable signal, the FF will be set by the first pulse after a trigg
or serial polling.

OSCILLATOR AND DIVIDER. This circuit contains the internal osci
for external frequency sources.

10 MHz OSCILLATOR (U1). This oscillator is a crystal-controlled 10
is provided by a tunable capacitor in the crystal circuit. The cap
screwdriver adjustment on the rear panel (OSC ADJ). The 10 M
through buffer circuits, to the Prescale Select circuit.

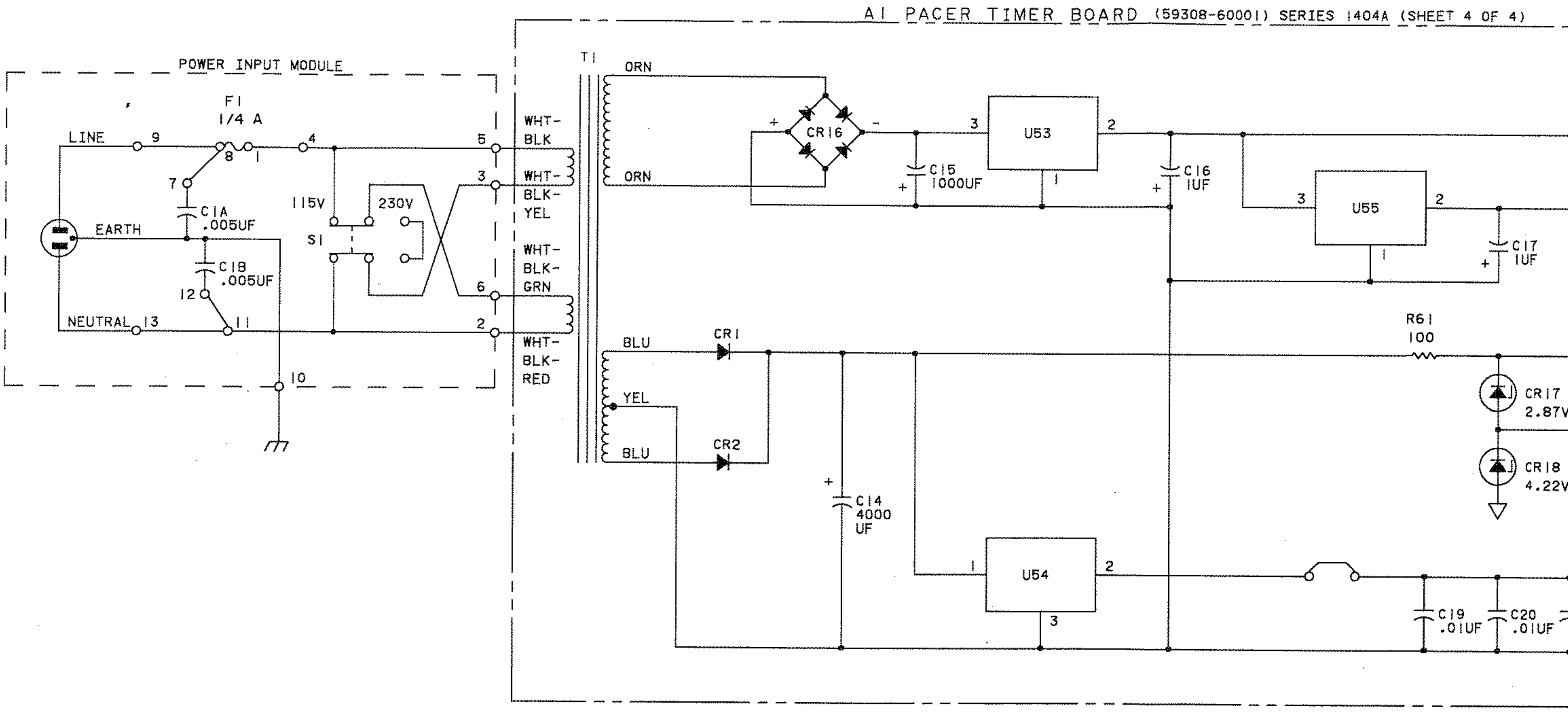
PRESCALE SELECT (U2). This select circuit routes the time base si
prescaling by the factor set on the rear-panel EXT FREQ STD 1-5-

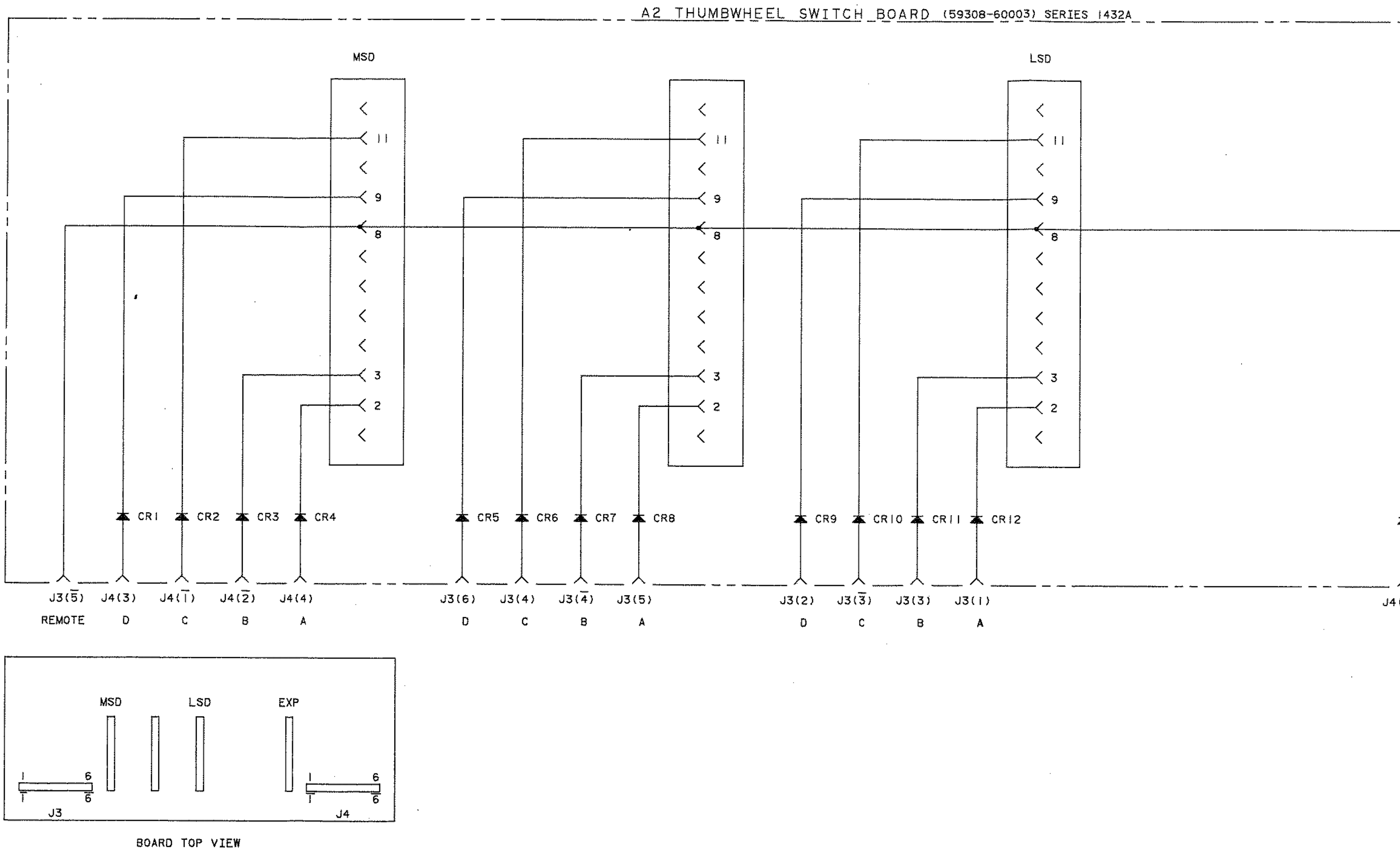
TIME BASE PRESCALER (U3). This prescaler divides the time base by
routing performed by the Prescale Select circuit.

Figure 8-3
A1 PACER TIMER BOARD SCHEMATIC DIAGRAM
(Sheet 2 of 4)

POWER SUPPLY (Figure 8-3, Sheet 4). The power supply contains th
volts and –12 volts. Each regulator is a single-package type circuit. T
output. Input to the regulators is supplied from the ac line thr
transformer T1. One secondary winding of T1 is connected through a
regulator. The secondary winding of T1 is connected through a full-

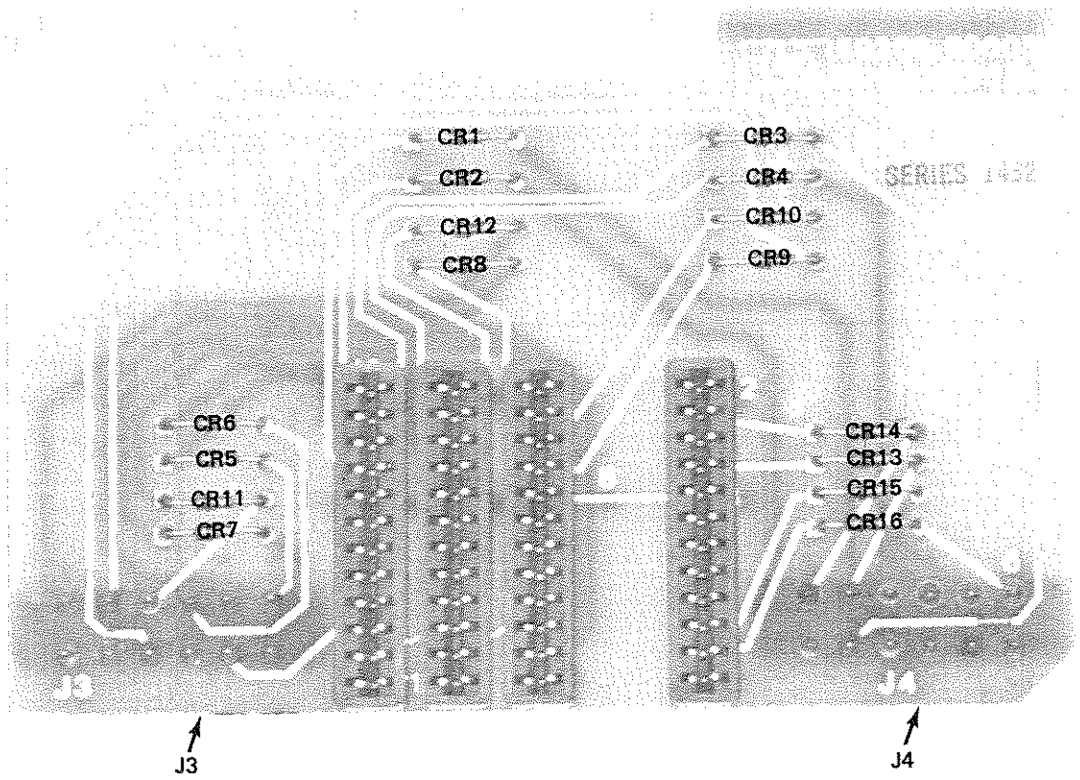
Figure 8-3
A1 PACER TIMER BOARD SCHEMATIC DIAGRAM
(Sheet 3 of 4)


A1 PACER TIMER BOARD (59308-60001) SERIES 1404A (SHEET 4 OF 4)
POWER INPUT MODULE
F1
1/4 A
LINE
EARTH
NEUTRAL
C1A
.005UF
C1B
.005UF
115V
230V
S1
WHT-
BLK
WHT-
BLK-
YEL
WHT-
BLK-
GRN
WHT-
BLK-
RED
T1
ORN
CR16
C15
1000UF
U53
C16
1UF
U55
C17
1UF
BLU
YEL
CR1
CR2
C14
4000
UF
R61
100
CR17
2.87V
CR18
4.22V
U54
C19
.01UF
C20
.01UF


A2 THUMBWHEEL SWITCH BOARD (59308-60003) SERIES 1432A
MSD
LSD
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
CR11
CR12
J3(5̄)
REMOTE
J4(3)
D
J4(1̄)
C
J4(2̄)
B
J4(4)
A
J3(6)
D
J3(4)
C
J3(4̄)
B
J3(5)
A
J3(2)
D
J3(3̄)
C
J3(3)
B
J3(1)
A
MSD
LSD
EXP
J3
J4
BOARD TOP VIEW

A2 THU

Figure 8-3
A1 PACER TIMER BOARD SCHEMATIC DIAGRAM
(Sheet 4 of 4)



REFERENCE DESIGNATIONS
A2
CR1 - CR16 P3, P4 S1 - S4

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

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HEWLETT PACKARD

MANUAL CHANGES

MANUAL DESCRIPTION

INSTRUMENT: 59308A Timing Gen. Operating and Service Manual
SERIAL PREFIX: 1508A

DATE PRINTED: JUNE 1975
HP PART NO: 59308-90004
MICROFICHE NO: 59308-90005

CHANGE DATE September 12, 1977

(This change supersedes all earlier dated changes)

- Make all changes listed as ERRATA.
- Check the following table for your instrument's serial prefix or serial number and make listed change(s) to manual.

IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL	IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL
1524A	1	1604A	1,2,3
1600A	1, 2	1632A	1,2,3,4
		►1740A	1,2,3,4,5

► NEW OR REVISED ITEM

ERRATA

The "ASCII PROGRAMMABLE MODULE" on the bottom of the front panel is changed to "HP-IB PROGRAMMABLE MODULE" with HP-IB as an abbreviation for Hewlett-Packard Interface Bus.

Page 2-1, Paragraph 2-9, last sentence:
Change to read "correct position (115 or 230) and the correct fuse (250 mA for 115V and 125 mAT for 230V) must be installed."

Page 3-10, Paragraph 3-24:
Replace with following:
"3-24. When the 59308A is addressed to talk it will output an 8-character word serially on the interface bus. The output will indicate the number of timing periods that have occurred between the last trigger and the address to talk command. The talk output on the bus DIO lines is shown in Table 3-4.

Page 6-3, Table 6-1, A1 Replaceable Parts:
Add A1J8: 1251-3283; CONNECTOR: 24-CONT FEM; 28480; 1251-3283
Add A1J8: 1530-1098; FASTENER: 0.136" DIA 6-32 THREAD; 00000;OBD
Change A1Q1, A1Q2 from 1854-0071 to 1854-0246; 2; TRANSISTOR NPN SI PD=350 MW FT=250 MHz; 04713; SPS 233
Change A1Q3 "Qty" column to 5.

Page 6-3, Table 6-1, A1 Replaceable Parts:
Change A1U4 "Qty" column from 3 to 4.
Change A1U16 "Qty" column from 4 to 3.
Change A1U30 from 1820-0586 to 1820-0584; IC DGTL DM74L 02N GATE; 27014; DM74L02N.

Page 6-5, Table 6-1, Replaceable Parts
Change "Reference Designation" of A2S1, A2S2, A2S3, and A2S5 to A2XS1A, A2XS1B, A2XS1C, and A2XS1D, respectively.

2-5850-6135-6147-6379-6448-6467-6607-7073-7510

ERRATA (Cont'd)

Page 6-6, Table 6-1, Replaceable Parts:
Add CHASSIS PARTS listed in attached table to Table 6-1 of manual.

Page 8-5, Figure 8-3, A1 Schematic Sheet 1 of 4:
Add attached Figure 1. A4 LAMP BOARD ASSY SCHEMATIC DIAGRAM.

Page 8-7, Figure 8-3 (Sheet 2 of 4):
Add J3(5) to A2 THUMBWHEEL SWITCH board terminals and connect to "REMOTE" line going to U36 (9, 5, 2, 12).

Add "A3J1" adjacent to TRIGGER INPUT jack on A3 REAR PANEL BOARD and A3J2 on 1V RMS jack on same circuit board.

Add J1 adjacent to "OUTPUT TTL" jack and J2 adjacent to "OUTPUT ECL" jack. These two jacks appear on the bottom right corner of the diagram.
Change cable between A2 and A3 to A3W1 and part number from 8120-1833 to 812-1966.

Page 8-13, Figure 8-4, A2 REFERENCE DESIGNATIONS Table:
Change P3, P4 to J3, J4.
Change S1-S4 to XS1A-XS1D.

Table of Chassis Parts

Reference Designation	HP Part No.	Qty.	Description	Mfr. Code	Mfr. Part No.
			CHASSIS PARTS		
C1	0160-3043	1	CAPACITOR:FXD DUAL .005UF 20%	56289	29C147A-CDM
F1	2110-0004	1	FUSE:250 mA 250V	75915	312.250
F1	2110-0318	1	FUSE:125 mA S.B. 250V	75915	313:1255
J1, J2	1250-0083	2	CONNECTOR:RF BNC	24931	28JR-130-1
S1	3100-3274	1	SWITCH:THUMBWHEEL	28480	3100-3274
T1	9100-3038	1	TRANSFORMER:POWER	28480	9100-3038
W1	8120-1378	1	CABLE ASSY:3 CONDUCTOR	70903	KH-7081
W2	59308-60005	2	CABLE ASSY:COAXIAL	28480	59308-60005
W3	59308-60005		CABLE ASSY:COAXIAL	28480	59308-60005
XDS1	5040-0270	3	LAMPHOLDER:WHITE LENS	28480	5040-0270
XDS2	5040-0270		LAMPHOLDER:WHITE LENS	28480	5040-0270
XDS3	5040-0270		LAMPHOLDER:WHITE LENS	28480	5040-0270
	3101-0851	2	CAP:PUSHBUTTON	09353	7089-2
	5060-1196	1	MODULE:POWER LINE INPUT	28480	5060-1196

NOTE

FOR CABINET PARTS REFER TO PAGE 6-8, TABLE 6-2.

Page 6-3, Table 6-1, A1 Replaceable Parts:
Change A1C5 and A1C19 through A1C22 from HP Part No. 0160-3277 to 0160-3879; CAPACITOR-FXD .01 UF +-20% 100WVDC CER; 28480; 0160-3879.

Page 2 of these MANUAL CHANGES, Tables of Chassis Parts:
Change 3101-0851 Cap, Push Button Switch (Black) to 3101-1820; Cap, Push Button Switch (White); 28480; 3101-1820.

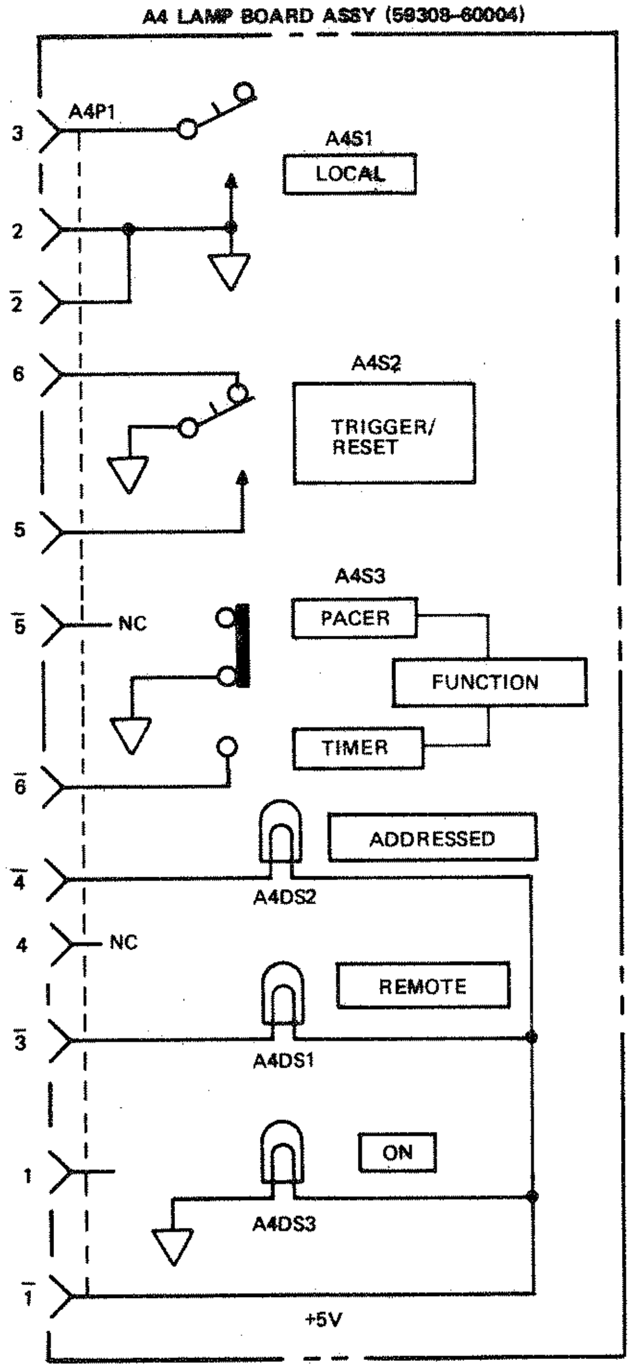


Figure 1 A4 LAMP BOARD ASSY SCHEMATIC DIAGRAM

ERRATA (Cont'd)

Page 3-7, Paragraph 3-17, Subparagraph f:
Change paragraph to read as follows and add NOTE.

"f. Select the period of the output signal by sending three digits and "E" followed by another digit or four digits (see Table 3-3). The first three digits are the time digits and the fourth is the exponent. For example, 123E4 or 1234 equals 123 X 10^4 us."

NOTE

The 59308A interprets the last four digits received as the time code. A decimal point before, between, or following any of these four digits is ignored. When using a calculator variable as the time code the variable, when outputted, must be formatted so the last four digits are the desired time code.

Page 3-8, Table 3-2, TIME function:
Change "(E ±)D" in first line under TIME to "(E) (±)D".

Page 5-3, Table 5-2, Performance Check:
Change "(ASCII "A") in last line of NOTE under REMOTE OPERATION to "(ASCII "U")."
Change "(ASCII "U")" in first line of step 20 to "(ASCII "A")."
Change "(ASCII "A")" in step 21 to "(ASCII "U")."

Page 8-9, Figure 8-3, A1 Sheet 3 of 4 Schematic:
Change "U38A", in upper left corner of schematic to "U8A."

Complete the connection between A1U6E(10) and A1U18A(1) in bottom center portion of schematic.

Page 6-3, Table 6-1, A1 (59308-60001) Replaceable Parts:
Change A1CR16 from 1906-0027 to 1901-0366; DIODE-FW BRIDGE 400V 1A; 02037; SDA-10185-6. This bridge is recommended replacement for all instruments.

Page 8-5, Figure 8-3 (sheet 1 of 4), A1 Schematic Diagram:
Add hex inverter U28B (3,4) in series with line between common junction of J8(3), R2(5), U10(11), U26(5), U25(15), and U27(5) and input to common junction of U21A(2), U21B(12), and U50A(2). Output pin 4 of U28B goes to U21(2,12) and U50A(2); input pin three to J8(3).

CHANGE 1 (1524A)

OPERATING NOTE – The "rocker" type switches for rear-panel CONTROL SWITCHES (A1S1 with 7 SPST sections) is changed to a slide switch with seven SPST sections. A paint dot located on one corner of the slide switch is used as a reference to determine switch positions for the seven switch sections. Sections A6 and A7 are not used.

Sliding a switch section to the side with the dot opens the switch contacts. This is equivalent to a "0" state as shown in Table 3-1. Address Switch Settings given on page 3-6.

Sliding a switch section in the opposite direction, away from the paint dot, closes the switch contacts for a "1" state as shown in Table 3-1.

Page 6-3, Table 6-1, A1 Replaceable Parts:
Change "SERIES 1432" in "Description" column for A1 to "(SERIES 1524A)".

Page 6-3, Table 6-1, A1 Replaceable Parts:
Change A1S1 from 3101-1826 to 3101-1973; SWITCH ASSY: SLIDE DIP (7-SPST); 28480; 3101-1973.

Page 8-5, Figure 8-3, A1 Schematic Diagram (Sheet 1 of 4):
Change "SERIES 1404A" at top of schematic to SERIES 1524. Mark schematic to indicate CONTROL SWITCHES are A1S1 and part of circuit board assembly A6.

Page 8-7, 8-9, and 8-11, A1 Schematic Diagram (Sheets 2, 3, and 4):
Change "SERIES 1404A" at top of schematic to SERIES 1524.

Page 2 of these MANUAL CHANGES, Table of Chassis Parts:

Change power line module from 5060-1196 to 0960-0444 (formerly 5060-9422) in "HP PART NO." and "MFR. PART NO." columns.

A universal power module (HP Part No. 5060-9422 or 0960-0444) is used in this instrument. The module is wired for operation from 115V or 230V ac power lines as per the specifications given in Section I of this manual and as marked on the rear of the instrument.

Power line connections are selected by a plug-in circuit card in the module. When the card is plugged into the module, the only visible markings on the card indicate the line voltage to be used. The correct value of line fuse, with a 250 volt rating, must be installed after the card is inserted. This instrument uses a 250 mA, 250V fuse (HP Part No. 2110-0004) for 115 volt operation; a 125 mAT fuse (HP Part No. 2110-0318) for 230 volt operation.

To convert from one line voltage to another, the power cord must be disconnected from the power module before the sliding window covering the fuse and card compartment can be moved to expose the fuse and circuit card.

Pull on the fuse lever to remove the fuse and then pull the card out of the module. The fuse lever must be held to one side to extract and insert the card. Insert the card so the marking that agrees with the line voltage to be used is visible. Use the "115/120" marking for 115 or 120 volt power lines; the "230/240" marking for 230 or 240 volt power lines.

Return fuse lever to normal position, insert correct fuse, slide plastic window over the compartment, and connect the power cord to complete the conversion.

NOTE

IF POWER MODULE CARD IS PLUGGED INTO THE MODULE WITH THE "100" OR "220" MARKINGS VISIBLE, THIS INSTRUMENT WILL NOT OPERATE.

Page 8-11, Figure 8-3, A1 Schematic sheet 4:
Change diagram to agree with ac power module connections shown in attached Figure 2.

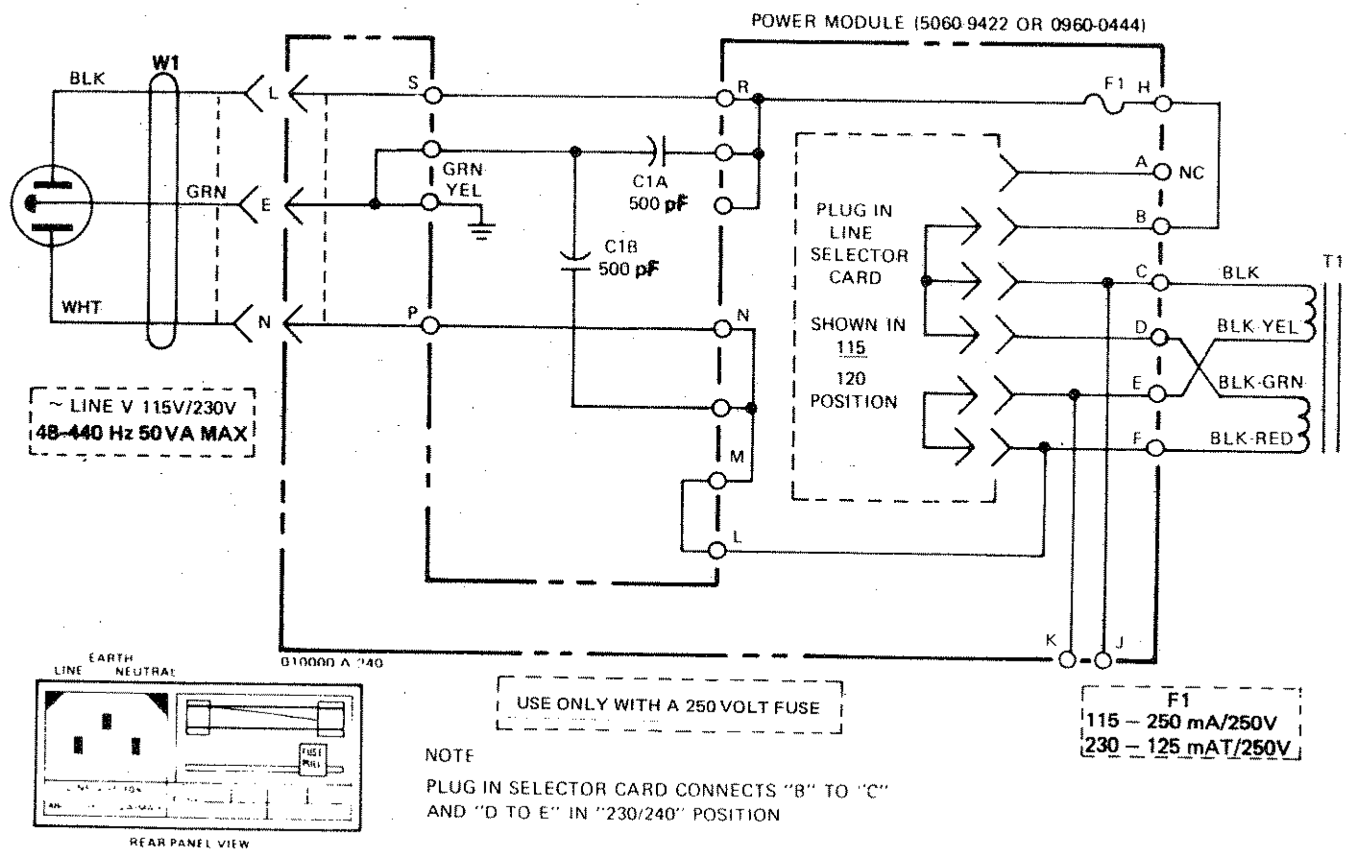


Figure 2. Primary Power Connections (Serial Prefix 1524A)

CHANGE 2 (1600A)

The two mounting studs for the HP-IB connector are changed from 0380-0513 to 0380-0644. The 0380-0644 hex studs accommodate lock screws with ISO metric thread M3.5 x 0.6 or equivalent Optimum Metric Fastener System (OMFS) thread 3.5 PO6.

Metric hardware supplied by HP for HP-IB connectors can be identified by the black finish. If metric tools are not available, a 9/32 inch hex socket will fit the 7 mm hex stud.

Conversion Kits for converting earlier instruments to use the metric lock screws are available through any HP Sales or Service Office.

CAUTION

THE THREADS OF THE METRIC HARDWARE WILL NOT FIT THE 6-32 UNC THREADS ON HARDWARE WITH A SILVER FINISH. THE THREADS WILL STRIP IF THE HARDWARE IS INTERMIXED.

Page 1-4, Table 1-1 Specifications:
Add "POWER REQUIREMENTS" of 115 Vac or 230 Vac ±10%, 48 to 440 Hz, 50 VA maximum.
Make corresponding changes in attached Figure 2 and change caption to Serial Prefix 1600A.

Page 2 of these MANUAL CHANGES, Table of Chassis Parts:
Change two listings for fuse F1 to the following:

2110-0201; 250 mAT 250V 1.25 x .25 UL/IEC; 75915; 313.250S
2110-0202; 500 mAT 250V 1.25 x .25 UL/IEC; 75915; 313.500S

NOTE

Use .5A 250V SLO-BLO fuse (2110-0202) for 115V operation or .25A 250V SLO-BLO fuse (2110-0201) for 230V operation. This supersedes information given in Change 1. Change fuse ratings in attached Figure 2 and in paragraph 2-9 on Page 2-1 of Operating and Service Manual.

CHANGE 3 (1604A)

Page 2 of these MANUAL CHANGES, Table of Chassis Parts:
Change C1 from 0160-3043 (dual .005 μF) to 0160-3333; CAPACITOR FXD .005 μF 20% 250 WVAC CER; 28480; 0160-3333.

Page 8-11, Figure 8-3, A1 Sheet 4 of 4 Schematic Diagram:
Replace C1A and C1B with a single .005 UF capacitor connected between the terminals of the ac power connector on the power module. Remove the common connection between C1A and C1B and chassis ground.

Make same corresponding change in attached Figure 2 for the Power Module connections and change caption to "Serial Prefix 1604A".

Page 1-0, Figure 1-1, Model 59308A and Equipment Supplied:
Delete 10631A Hewlett-Packard Interface Bus Interconnect Cable. This instrument is furnished less the HP-IB cable which is available as an additional cost accessory. Disregard any manual references stating the instrument is supplied with the HP-IB cable assembly.

Page 1-4, Table 1-2, Equipment Supplied:
Delete 10631A HP-IB Interconnect Cable.

Page 8-5 thru 8-11, Figure 8-3, A1 Schematic Diagrams:
Change SERIES number at top of schematic to "1604."

CHANGE 4 (1632A)

Page 6, Table 6-1, A1 (59308-60001) Replaceable Parts:
Change A1 series number from 1524 to 1632.

Change A1Q1 and A1Q2 from 1854-0246 (2N3643) to 1854-0492; TRANSISTOR NPN SI PD = 350 MW FT = 250 MHz; 28480; 1854-0492.

Change A1U4, A1U29, A1U30, and A1U48 from 1820-0584 (74L02) to 1820-1144; IC DIGITAL TTL LS QUAD 2 NOR; 01295; SN74LS02N.

Change A1U5, A1U21, and A1U50 from 1820-0596 (74L74) to 1820-1112; IC DIGITAL TTL LS DUAL; 01295; SN74LS74N.

Change A1U12, A1U34, and A1U49 from 1820-0587 (74L10) to 1820-1202; IC DIGITAL TTL LS TPL 3 NAND; 01295; SN74LS10N.

Change A1U16, A1U28, and A1U40 from 1820-0586 (74L04) to 1820-1199; IC DIGITAL TTL LS HEX; 01295; SN74LS04N.

Change A1U19 and A1U20 from 1820-1047 (74L42A) to 1820-1418; IC DIGITAL TTL LS 4 BCD-TO-DEC; 01295; SN74LS42N.

Change A1U23 from 1820-0710 (93L22) to 1820-1470; IC DIGITAL TTL LS QUAD 2; 01295; SN74LS157N.

Change A1U31, A1U33, and A1U41 from 1820-0583 (74L00) to 1820-1197; IC DIGITAL TTL LS QUAD 2 NAND; 01295; SN74LS00N.

Change A1U36 through A1U39 from 1820-0585 (74L03) to 1820-1198; IC DIGITAL TTL LS QUAD 2 NAND; 01295; SN74LS03N.

Pages 8-5 thru 8-11, Figure 8-3, A1 Schematic Diagram:
Change series numbers, at top of A1 schematics, from 1604 to 1632.

► CHANGE 5 (1740A)

► Page 2 of these MANUAL CHANGES, Table of Chassis Parts:
Change C1 from 0160-3333 (single .005 μF) to 0160-0676; CAPACITOR-FXD DUAL .0018 μF 10% CERAMIC; 28480; 0160-0676.

NOTE — This change supersedes information given under ERRATA and CHANNEL 3. Capacitors C1A and C1B in Figure 2 of these MANUAL CHANGES should be changed to .0018 μF.

► Pages 8-5, 8-7, 8-9, and 8-11, Figure 8-3 sheets 1-4; A1 Schematic Diagram:
Change series number, at top of each diagram, from 1632 to 1740.

► Page 8-11, Figure 8-3 sheet 4, Schematic Diagram:
Change C1A and C1B in Power Input Module to .0018 μF each.

► Pages 6-3 thru 6-5, Table 6-1, A1 (59308-60001) Replaceable Parts:
Change A1 series number from 1632 to 1740.

Add A1C23; 0180-1735; CAPACITOR-FXD .22 UF 10% 35VDCW TANT; 56289; 250D224X9035A2.

Add A1C24; 0160-4084; CAPACITOR-FXD 0.1 UF 20% 50VDCW CER; 28480; 0160-4084.

Add A1R66; 0757-0898; RESISTOR-FXD 82Ω 2% .125W F TC = 0+-100; 24546; C4-1/8-TO-82R0-G.

Change A1U16, U28, and U40 from 1820-1199 (74LS04) to 1820-1416; IC TTL SCHMITT-TRIG LS INV HEX 1-INPUT; 01295; SN74LS14N.

► CHANGE 5 (1740A) (Cont'd)

► Page 8-5, Figure 8-3 Sheet 1 of 4, A1 (59308-60001) Schematic Diagram:

Change REFERENCE DESIGNATIONS table listings for A1 capacitors to "C1-C24" and resistors to "R1-R66."

Add 82 ohm resistor A1R66 in series between output pin 4 of A1U29B and the input to A1U33D(12) and A1U34C(9).

Add 0.1 UF capacitor A1C24 between circuit board common and the junction of A1R66, U33D(12), and U34C(9).

Add pin 12 to A1J8 DIGITAL BUS connector and show a wire connecting this pin to the rear chassis.

► Page 8-11, Figure 8-3 Sheet 4 of 4, A1 (59308-60001) Schematic Diagram:

Add .22 μF electrolytic capacitor A1C23 between circuit board common (A1U54 pin 3) and the input to pin 1 of five volt regulator A1U54. Positive side of capacitor to pin 1 and negative side to common.